

county has contracted another firm, Cogan and Associates, to evaluate land use and develop a siting standard. A total of \$11,500 has been allocated for the two studies.

Independent of the studies, County Health Officer Dr. Charles Schade has formed a blue ribbon committee to review the work of Dr. William Morton of the University of Oregon's Health Sciences Center in Portland. Several years ago, a study by Morton revealed a significantly higher incidence of uterine cancer in Portland's West Hills section, which has the highest RF/MW radiation levels in the city. Neighborhood opposition to adding a transmitter to an antenna farm in this area eventually led to the city's adoption of an Interim Radiofrequency Emission Standard in 1980.

...Unexpected Results Found in Portland Cancer Study

A study on the incidence of certain cancers among Portland, OR, residents has found a significant correlation between three types of cancer and radiofrequency/microwave (RF/MW) radiation levels, according to Dr. William Morton of the University of Oregon's Health Sciences Center in Portland. Morton recently submitted a preliminary report on the study, which began in 1978, to the Environmental Protection Agency's (EPA) Experimental Biology Division.

Acting Division Director Dr. Joe Elder has just taken over and said he had not had a chance to study the report.

Morton indicated that RF power density levels positively correlated to the number of reported cases of lymphatic leukemia, adenocarcinoma of the uterus and breast cancer. No correlation was found for non-lymphatic leukemia and cancer of the pancreas.

Morton said that he had not anticipated these results. He was particularly surprised that for the three frequency bands examined, the correlations occurred with the low and high VHF TV bands (54-88 MHz and 176-216 MHz respectively), and not with the FM radio band (88-108 MHz) where power density levels are relatively much higher. Calculated radiation levels ranged from under 0.004 to under 0.018 $\mu\text{W}/\text{cm}^2$ for low and high VHF TV and from under 0.013 to under 0.44 $\mu\text{W}/\text{cm}^2$ for FM radio. These averages were extrapolated from EPA measurements taken in 1977.

Now that the preliminary report is complete, Morton will seek EPA funding for another year of work. His last EPA grant ran out at the end of 1980.

US-USSR Tentatively Agree on Measurement Work Plan

Members of the US-USSR Working Group for Metrology have agreed on a provisional work plan for cooperation during a visit by three Soviet scientists last December, according to Dr. Arthur McCoubrey, associate director for measurement services at the National Bureau of Standards (NBS). The plan, which is still subject to formal approval, would result in the exchange of technical information—including the measurement of non-ionizing radiation fields. Later, there would be an exchange of visits by research scientists.

Dr. Donald McRee of the National Institute of Environmental Health Scientists participated in the talks and said that he was pleased with their outcome. "This could give us the opportunity to learn about the Soviets' capability to measure fields in bioeffects research," he said.

Ric Tell of the Environmental Protection Agency's radiation lab in Las Vegas, NV, one of the labs on the Soviets' tour,

said that he felt the trip was more of a fact-finding mission and that he hoped there would be an opportunity for technical discussions at later meetings. Tell was particularly interested in comparing radiation hazard instruments and field survey data with the Soviets.

The microwave expert on the Soviet delegation was A.I. Mekhanikov, who is the deputy director of VNIIFTRI—the All Union Scientific Institute for Physico-Technical and Radio-Technical Measurement—north of Moscow. The institute is akin to the NBS labs in Boulder. The head of the delegation was L.K. Isayev, who is the chief of metrology administration at Gosstandart.

New Findings at Hopkins Lab

Preliminary research indicates a new type of tissue damage from exposure to 2.45 GHz radiation at 10 mW/cm^2 , according to Dr. Samuel Koslov of the Johns Hopkins University's Applied Physics Lab. Koslov announced the new findings at last December's ERMAC meeting (see page 1). While 1 mW/cm^2 may be a safe level at GHz frequencies, he said, 5 mW/cm^2 may not be safe for prolonged exposures.

The Hopkins researchers are not ready to publish the results, nor was Koslov willing to be more specific about the type of effect or susceptible organ. Koslov did express his concern that, if this effect is confirmed, it would mean that the new ANSI standard, which allows exposures of 5 mW/cm^2 above 1.5 GHz, would not provide enough protection for the public. "I would have violent objections to the application of the ANSI standard in the upper frequency range if applied to the general population," he warned.

Workshop on Behavioral Effects

An interdisciplinary workshop on *Behavioral Effects of Microwave Radiation Absorption* is tentatively scheduled for March 16-19 at the Homestead Lodge near Salt Lake City, UT. The first day of the meeting will be devoted to a literature review; the second to contemporary topics, including drug-microwave synergy, chronic exposure studies, dosimetry and extrapolation among target systems; and the third to future directions for research.

The workshop is open to all; there will be a \$50 registration fee. For more information contact Professor John D'Andrea at the Department of Electrical Engineering, University of Utah, Salt Lake City, UT 84112, (802) 581-8590 or 851-6943.

Changes at EPA

Dr. Daniel Cahill has left the Environmental Protection Agency (EPA) to go work for Carolina Light and Power (CP&L). Dr. Joe Elder is filling in as acting director of the agency's Experimental Biology Division in the Office of Research Development in Research Triangle Park, NC. In an interview, Cahill said that the change was a "career move: I just ran out of room."

Meanwhile back at the agency's headquarters in Washington, Dr. Gordon Burley is still the acting director of the Office of Radiation Programs. Burley replaced Dr. David Rosenbaum, who left EPA to start his own consulting firm: Technical Analysis Corp. of Arlington, VA. Rosenbaum said that he had decided to leave as a result of the budget cuts and lay offs. "I could see it was only going to get worse," he said. Burley had been chief of the environmental standards branch and moved up when Rosenbaum and three division directors all left.

UPDATES

Biological Effects.... NASA has issued a new literature review, *Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories*. The report, prepared for NASA by Dr. Jeremy Raines of Techovators of Rockville, MD, is available from the National Technical Information Service, Department of Commerce, Springfield, VA 22161. It can be ordered by its NASA document number: N81 25668; \$12 for a paper copy and \$4 for microfiche.... Professor Edward Grant of Queen Elizabeth College, London, has published a short article on the "Biological Effects of Microwaves and Radio Waves," in the *Proceedings of IEE (UK)*, 128, Pt A, 602, December 1981. Grant sums up with "the 10 mW/cm² standard, although adequate at frequencies in excess of 1 GHz, is too high in respect of lower frequencies, and needs revision."... Dr. Ewa Manikowska-Czerska, a visiting scientist at BRH, is scheduled to present a seminar on "Meiotic Chromosome Aberrations and their Biological Significance Following Microwave Exposure" on February 2 in Bethesda.... BRH's Dr. Whit Athey has raised some objections to a model devised by EPA's Drs. William Joines and Carl Blackman which allows them to scale the internal electric fields that induce calcium efflux from chick brain tissue. Athey thinks that the uncertainties are too large to allow conclusions to be drawn from the model. Joines and Blackman reply with a new and more detailed version of the model; this too is consistent with the data. In an interview, Blackman said that, while he agrees that the model is not thoroughly validated, he thinks it has less uncertainty than Athey indicates in his paper. For both points of view, see *Bioelectromagnetics*, 2, 407-413, 1981.... Drs. Ernest Albert and James Kerns of George Washington University describe their recent experiments on the effects of microwaves on the blood brain barrier (BBB) in *Brain Research*, 230, 153, 1981. Two-hour exposure with 2.45 GHz CW at 10 mW/cm² resulted in reversible permeability of the BBB to horseradish peroxidase.... EPA's Claude Weil proposes a terminology system for dosimetry in the December issue of the *Bioelectromagnetics Newsletter*.... A group headed by Albert Friend, Jr. of the Naval Electronic Systems Command in Washington has published a paper in the *IEEE Transactions on Microwave Theory and Techniques*, MTT-29, 1271, December 1981, which indicates "no hemolysis in red blood cells exposed *in vitro* to large microwave pulse with peak SAR's of more than 1 kW/g."... The NY Overhead Power Lines Project is still scheduling a meeting for February 19-21 in New York City. For more information contact: Dr. Maria Reichmanis at (518) 474-3215.... Some have speculated that Russian radar is responsible for the increased incidence of heart disease among Finns living in North Karelia. Beginning in 1972 a program was initiated to try and control the risk of disease. A five-year report of the North Karelia Project is described in the *American Journal of Public Health*, 72, 43, January 1982. While the data show some encouraging results, they are far from conclusive. Microwaves were not included in the discussion.... Linda Garmon reviews research on the effects of ions in the December 5 *Science News*.

Communications.... The National Association of Broadcasters' (NAB) Advisory Committee on Radiation and Regulation has informed the EPA that it supports a national population exposure standard for non-ionizing radiation. In a December 14 letter to Kathleen Bennett, assistant administrator for air, noise and radiation, the NAB urged sufficient funding be provided to complete a guidance and stated "there are sound economic, scientific and policy reasons for our position." Citing increasing state and local rule making, a December NAB memo to its state officers carried the same message.... A public forum for users of the Private Operational-Fixed Microwave Service, sponsored by the Private Radio Bureau, will be held in Washington, DC, on March 31. Topics on the agenda include interference analysis and public access to microwave applications and data base information. Contact: John Small, FCC, Room 8202, Washington, DC 20554, (202) 632-7197.... The FCC affirmed its earlier ruling giving AT&T half of each new cellular communications market on December 17. (See *MWN*, May 1981.) Twenty-five potential competitors to AT&T had petitioned the commission to reconsider its April ruling.... Now the commission has begun an inquiry on the future needs of private land mobile radio users, a group including

police, doctors, utility crews and taxi drivers (NOI No. 82-8). Contact: FCC's Joseph Levin, (202) 254-3301.... In another inquiry, the FCC is asking for comments on the allocation of the 40.5-400 GHz spectrum to comply with the 1979 WARC actions (46 *Federal Register* 60221, December 9).... Air-to-ground telephones will enable American Airlines passengers to make calls while airborne. Airfone, Inc. is installing the one-way system on some planes this year.... Arthur D. Little, Inc., of Cambridge, MA, is developing a search scenario for detecting and locating trapped miners using radio transmitters under a \$108,000 contract from the US Bureau of Mines. According to ADL's Robert Lagace, the system's ability to transmit detectable rescue signals to the surface in the 500-3,000 Hz frequency range has been recently tested in some 94 mines in US coal fields. The bureau has sponsored the development of both seismic and electromagnetic trapped miner location systems since 1970.... RCA plans to build nationwide communications networks among 50 cities. RCA Network Services, Inc. has joined 11 other applicants seeking FCC permission to start microwave digital termination systems.

Compatibility & Interference.... The FCC has issued a rule that will allow the commission to shut down any source of electromagnetic interference which could peril human safety or damage property (47 *Federal Register* 1392, January 13, 1982). The regulation is a result of EMI from TV news equipment, which affected the space shuttle's tracking and communications equipment during last April's flight. Now the FCC's Chief of Field Operations can order broadcasters or cable operators to shut down interfering equipment.... Comsearch, Inc., of Falls Church, VA, and Chomerics, Inc., of Woburn, MA, have set up measurement laboratories for EMI and EMC tests.... The Navy has awarded BE&C Engineers, Inc., of Tukula, WA, a subsidiary of Boeing, more than \$4 million to deliver an electronic warfare and EM environmental effects test facility.... And the Naval Surface Weapons Center in Dahlgren, VA, has issued a \$902,000 contract to Eldyne of San Diego, CA, for engineering design support for EMC.... The Naval Sea System Command intends to ask for EMI services next month (*Commerce Business Daily*, January 25).... The Rome Air Development Center is looking for a contractor to assess EMC in C³ systems which use microelectronics.... The National Association of Broadcasters' Radio Board is trying to secure government help to stop interference to AM stations from Cuba.

Government.... Everyone is waiting for the president to unveil his FY83 budget. Among the leaked items are OMB proposals to phase out the Public Health Service Commissioned Corps, to further cut the EPA budget, to close down some FDA labs and to kill the NASA 30/20 GHz program (see satcom updates).... Barry White, a former OSHA regional administrator, has been named to head OSHA's directorate of Safety Standards Programs.... After the *New York Times* ran a story about the antennas on the Soviet embassy in Washington, DC being used for surveillance (December 11), the embassy issued a denial. In a follow-up piece on December 21, a spokesman for the FBI reaffirmed the accusation.... About a hundred people attended the Technical Electronic Product Radiation Safety Standards (TEPRSSC) meeting in Rockville, MD, December 9-10. RCA's Howard Johnson, a member of TEPRSSC, proposed that BRH consider a generic regulatory approach to reducing leakage from all electronic products which emit non-ionizing radiation. BRH Director John Villforth replied that he did not agree with such an approach.... BRH has issued a new subject index for its publications, dated October 1981 (No. FDA 82-8070).... The FAA has issued final rules prescribing minimum standards for microwave landing systems (MLS) not operated by the federal government (46 *FR* 61560, December 17).... And at the end of January, the FAA unveiled a 20-year, \$9-billion plan to modernize the air traffic control system.... The Department of Commerce is looking for someone to review NTIA's Spectrum Management Program (*Commerce Business Daily*, December 18).

IEEE....The responses to the IEEE's Committee on Social Implications of Technology's (CSIT) editorial on the Committee on Man and Radiation's (COMAR) draft position paper on human exposure to RF/MW appear in the December issue of *Technology and Society*, the CSIT newsletter. (See *MWN*, October 1981.)

Litigation....A defense motion to dismiss Nettie Yannon's suit against RCA in the New York State Supreme Court, Richmond County, was denied this January.

Measurement....The Department of Commerce has approved a request to develop a voluntary laboratory program (LAP) for electromagnetic calibration services. The request was made some six years ago by Dr. Bruno Weinschel of Weinschel Engineering in Gaithersburg, MD, who said that while he was pleased with the decision, he felt it had been a long time coming. The next step is to set up a workshop, probably in Washington, DC, to consider criteria for evaluating labs. ... Meanwhile NBS's MAP is growing. The measurement assurance program recently approved five labs on the West Coast, those at Boeing, Hewlett-Packard, Hughes, Rockwell and TRW. NBS is now looking at five labs back East and will be making a final selection in the spring.

Medical Applications....A team from Harvard reports hyperthermia can inhibit the activity of natural killer cells *in vitro* in the January 2 *Lancet*. The authors speculate that "fever may act as an immunoregulatory mechanism by decreasing NK activity." ... A group from UCLA compares ways of heating deep-seated tumors, including with the Magnetron unit, which failed to win FDA pre-market approval last year (see *MWN*, May 1981), in the *IEEE Transactions on Biomedical Engineering*, January 1982. They express a preference for sources which produce an electric field parallel to skin/fat/muscle interfaces. ... BRH's Christian Hochuli and Dr. Gideon Kantor describe temperature measurements with a minimally disturbing probe in microwave diathermy in the December issue of the *IEEE Transactions on Microwave Theory and Techniques*. ... Dr. Robert Balaban of the National Heart, Lung and Blood Institute in Bethesda, MD, arranged the session on the application of NMR in biology and medicine at this year's AAAS meeting. Many of the papers described work using P-31 NMR. ... The January 23 *Science News* reports from the AAAS meeting that scientists from the University of Hawaii and the California Institute of Technology have found that a rotating magnetic field appears to significantly retard the growth of a mouse tumor that contains magnetite. Human cancer cells are not known to contain such particles. ... Electro-Biology, Inc., is planning to offer one million shares of common stock to the public. ... A team from Finland describes the use of magnetic measurements—magnetic susceptibility plethysmography—to measure changes in total cardiac volume in the January *IEEE Transactions on Biomedical Engineering*.

Military Systems & Radar....The Navy Electronic Systems Command has awarded two \$3.5 million contracts for studies on the design of submarine laser communications, one to Lockheed Missiles and Space Co. in Palo Alto, CA, and one to TRW in Redondo Beach, CA. ... And the Office of Naval Research is negotiating with Sanders Associates of Nashua, NH, for research on blue-green noise measurements. ... *Discover* ran a piece on Project ELF in the January issue. ... In December, DoD won one of Senator Proxmire's Golden Fleece awards for the Navy's handling of a research program on the health effects of ELF radiation. A bull was kept at the Wisconsin Clam Lake facility as part of a program that even Vice Admiral G.R. Nadler acknowledged was useless from a scientific point of view. Cost: \$13,000. ... In other contract news, the Navy awarded \$1.6 million to GE in Syracuse, NY, and \$920,000 to Calsonic of Philadelphia, PA, for work on the AN/TPS-59—a D-band, long-range, 3-D air surveillance phased array radar. ... The Office of Naval Research is negotiating with Comsearch of Falls Church, VA, for below deck electromagnetic surveys and has awarded Ohio State University \$350,000 for research on electromagnetic radiation and scatter and \$1 million to SRI in Menlo Park, CA, for work on the over-the-horizon backscatter radar. ... The armament division at Eglin AFB wants to upgrade and modernize the DoD radar scatter facility at the White

Sands Missile Range, NM. ... And the AF wants to build an RF anechoic chamber at Wright-Patterson AFB, OH.

Ovens....The Association of Home Appliance Manufacturers (AHAM) has withdrawn its objection to BRH's proposed amendments to the microwave oven performance standard (see *MWN*, May 1981). In a November 24, 1981 letter to BRH, AHAM said it was satisfied by a FDA Advisory Opinion on the amendments released November 20. BRH will now republish the amendments in the *Federal Register*, where they appeared on November 28, 1980 (45 FR 79028). ... Microwave oven manufacturers had a good year in 1981, and AHAM forecasts an even better one for 1982. Shipments grew by 20% last year; a total of 4.3 million units were produced or imported. As of last November, AHAM expected factory shipments to increase to more than 4.7 million units in 1982, up almost 10%—the largest projected growth for any appliance. ... The *Washington Post* reports that DOE is in the process of canceling proposed rules that would have set minimum efficiency standards for major appliances including ovens. According to the December 21 item, OMB must still approve the DOE analysis. ... Raytheon's John Osepchuk writes that "there is almost vanishing probability of interference of today's pace-makers by today's microwave ovens," in an article in the November/December 1981 issue of *Microwave World*: "Debunking a Mythical Hazard." ... The Cooking Appliance Section of the International Microwave Power Institute (IMPI) has assembled a ten-year bibliography on microwave cooking. The cost of the report has still to be set. Contact: Ms. Diane Ellison, IMPI, 301 Maple Avenue West, Tower Suite 520, Vienna, VA 22180, (703) 281-1515. ... Cober Electronics, Inc., of Stamford, CT, has introduced a new, 6 kW microwave batch pre-heater (Model BPH-6000). ... And Cober has released a new brochure to describe its continuous microwave dewaxers for the precision casting industry. For a free copy, contact: Casting Industry Brochure, Cober Electronics, Inc., 102 Hamilton Avenue, Stamford, CT 06902.

Power Lines....Most of the recent issue of *Bioelectromagnetics* (Volume 2, Number 4) is devoted to studies of the biological effects of 60-Hz power lines. ... The third symposium on *Environmental Concerns in Rights-of-Way Management* is scheduled for February 15-18 at the Hyatt Islandia Hotel in San Diego, CA. Among the sessions is one on the health and safety of high power transmission lines and the siting of new energy facilities. Dr. Gus Tillman of the Cary Arboretum of the New York Botanical Gardens is chairing the session, which will feature speakers from Western Electric, Bonneville Power and Georgia Power. Contact: Lisa Lava-Kellar, 215 1/2 S. Main Street, Ann Arbor, MI 48104, (313) 996-2696.

Satellite Communications....Alascom, Inc.'s request to build a satcom station on Vashon Island, WA, was denied by the King County zoning adjuster on December 31. (See *MWN*, December 1981.) The company has appealed the ruling and a public hearing is scheduled for March 2 to review the decision. ... National Satellite Service, Inc., a Hughes Aircraft Company subsidiary, wants to build a satcom station in the Spring Creek area of Brooklyn, NY. A draft environmental impact statement for the proposed facility is being reviewed by the city before proceedings on a land use variance can begin. ... NASA is contracting Arthur D. Little, Inc. of Cambridge, MA, for a profile of the domestic satellite communications industry. ... OMB wants to cut NASA's 30/20 GHz program from the FY83 budget, according to the December 21 *Aviation Week and Space Technology*. NASA is reportedly appealing the cancellation. The funding picture may be looking better with the recent appointment of Dr. Burt Edelson, formerly of COMSAT, as NASA's head of science applications. ... Meanwhile, NASA has recently awarded close to one million dollars in contracts to ITT, General Electric and Western Union Telegraph for 30/20 GHz studies. ... During a review of its satellite services policies this January, the FCC invalidated RCA's November auction for transponder leases. (See *MWN*, December 1981.) At the same meeting, the commission decided to solicit public comment on whether satellite owners should be allowed to negotiate private sales of transponders. Under current FCC rules, use is allocated at fixed rates on a first-come, first-serve basis. ... *Compendium of Communication and Broadcast Satellites: 1958-1980*, edited by Martin P. Brown Jr., has been published by the IEEE Press. Cost: \$34.95, \$26.20 for IEEE

members. Order prepaid from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

Technology.... Research on electromagnetic launcher technology, or railgun, continues. The Defense Advanced Research Projects Agency has awarded the Rand Corp. in Santa Monica, CA, nearly \$300,000 to continue their work on it. The Air Force has its own program and is looking for a contractor to design and produce a railgun which can launch a projectile weighing ten grams with a muzzle velocity of 3 km/sec. For more information contact: AF's Bill Lucas, (904) 882-8240. Both projects are classified Secret. Nevertheless, *Science News* ran a progress report on the railgun in its December 12 issue.... Companies making anti-shoplifting devices are jockeying for new markets, especially supermarkets, according to a January 28 article in the *New York Times*. The industry is dominated by a few companies, including Sensormatic Electronics Corp. of Deerfield Beach, FL, Knogo Corp., of Hicksville, NY, and Checkpoint Systems, Inc., of Thorofare, NJ.... Raytheon's William Brown details the status of the microwave power transmission component for solar power satellites in the December *IEEE Transactions on Microwave Theory and Techniques*.... DOE's Laramie Energy Technology Center has awarded the University of Wyoming a \$75,655 contract to study the basic principles involved in RF retorting of oil shale.... In other contract news the Air Force has awarded the Polytechnic Institute of New York in Brooklyn \$277,000 for research on "Microwaves, Electromagnetic Theory and Information Processes," and NASA is negotiating with Ball Aerospace of Boulder, CO, for a "Shuttle Active Microwave Experiment."

VDTs.... Health and Ergonomic Considerations of Visual Display Units, a two-day seminar sponsored by the Ergonomics and Non-Ionizing Radiation Committees of the American Industrial Hygiene Association (AIHA) will be held March 1-2 in Denver, CO. Contact: J.R. Conti, AIHA, 475 Wolf Ledges Parkway, Akron, OH, 44311, (216) 762-7294.... The Ontario Ministry of Labor's advisory task force on video display terminals (VDTs) has finished its review of potential non-ionizing radiation health effects and is moving on to ionizing radiation. (See *MWN*, December 1981.) According to task force chairman Dr. Gordon Stopps of the University of Toronto's Occupational and Environmental Health Unit, no recommendations will be made before late spring or early summer.... The Newspaper Guild (TNG) and the International Typographical Union have published *Humanizing the VDT Workplace*, a 48-page health manual for local officers and shop stewards. The booklet is designed to help identify and eliminate VDT-related health and safety problems.... TNG has published its constitution, adopted at last year's guild convention, which includes its collective bargaining program and bargaining recommendations for VDT health issues. Copies are available from TNG, 1125 15th Street, NW, Washington, DC 20005.

LETTERS

To the Editor: I would like to draw your attention to an incorrect piece of news reported at the bottom of page 5 in your October issue. The London *Times* article did indeed imply that the National Radiological Protection Board (NRPB) had the only on-going microwave bioeffects research program in the UK, and that I had failed to obtain grants to carry out research in this area. You were quite entitled to draw these conclusions but in fact both are untrue.

I have a research team of eleven people and am supported financially in the UK by the NRPB itself, as well as by the Cancer Research Campaign. Generous support has also been provided by all three of the United States Armed Services and in addition I receive money from the NATO Scientific Affairs Division. I certainly would not like the impression to be given that my research team is short of funds and personnel; it would also be unfair to those organizations which support the research.

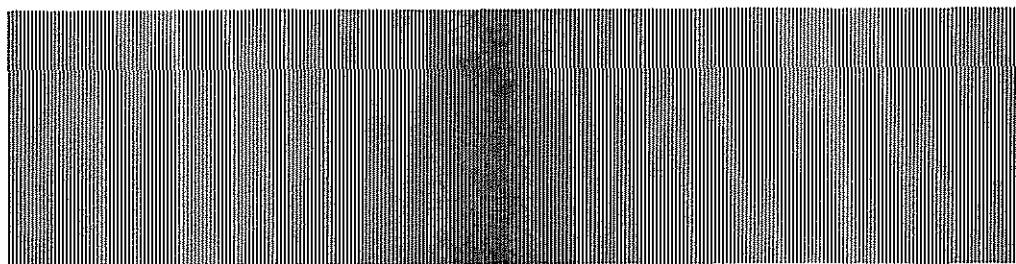
Professor E.H. Grant

Physics Department, Queen Elizabeth College, Campden Hill Road, London W8 7AH, United Kingdom.

CONFERENCE CALENDAR

- March 15-18: *International Workshop on Physics and Engineering in Medical Imaging*, Asilomar Conference Grounds, Pacific Grove, CA. Contact: University Extension, University of California, PO Box AZ, Irvine, CA 92716.
- March 29-April 2: *3rd International Congress of Thermology*, Bath, England. Contact: Congress Secretariat, Martlet Conference Services, 24 Preston Street, Brighton, Sussex BN1 2HN, England.
- April 21-23: *Biomedical Engineering Society Annual Meeting*, New Orleans, LA. Contact: Dr. Yoram Ruby, Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH 44106.
- April 26-28: *1982 Microwave Power Tube Conference*, Naval Postgraduate School, Monterey, CA. By invitation only, DoD Secret clearance required. Contact: Bill Lin, Litton Industries, 960 Industrial Road, San Carlos, CA 94070.
- May 24-28: *International IEEE/APS Symposium, National Radio Science Meeting and Nuclear Electromagnetic Pulse Meeting*, University of New Mexico, Albuquerque, NM. Contact: Dr. Kendall F. Casey, Dikewood Corp., 1613 University Blvd., NE, Albuquerque, NM 87102.
- June 7-8: *1st Southern Biomedical Engineering Conference*, Louisiana State University Medical Center, Shreveport, LA. Contact: Dr. S. Saha, Department of Orthopaedic Surgery, Louisiana State University Medical Center, PO Box 33932, Shreveport, LA 71130.
- June 15-17: *IEEE MTT-S International Microwave Symposium*, Hyatt Regency Hotel, Dallas, TX. Contact: J.R. Griffin, Texas Instruments, Mail Stop 3432, PO Box 405, Lewisville, TX 75067. On June 18 immediately after the conference, there will be a one-day workshop on *Medical Applications of Electromagnetic Energy*. Contact: Dr. Gordon Short, BSD Medical Corp., 420 Chipeta Way, Salt Lake City, UT 84108.
- June 28-July 2: *4th Annual Bioelectromagnetics Society Meeting*, Beverly Wilshire Hotel, Beverly Hills, CA. Contact: BEMS, 1 Bank Street, Suite 307, Gaithersburg, MD 20878.
- July 20-22: *IEEE Annual Conference on Nuclear and Space Radiation Effects*, Caesars Palace, Las Vegas, NV. Contact: A. Ochoa, Jr., Div. 2144, Center for Radiation-Hardened Microelectronics, Sandia National Laboratory, Albuquerque, NM 87185. This meeting will be followed on July 23 by the *Hardened Electronics and Radiation Technology Conference* hosted by the Defense Nuclear Agency. A Secret security classification is required to attend. Contact: Director, DNA, Attn: ISSO/Barbara Perkins, Washington DC 20305.
- July 25-30: *17th Annual Symposium of the International Microwave Power Institute*, Town and Country Hotel, San Diego, CA. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna VA 22180.
- August 11-13: *4th Annual Satellite Communications Users Conference*, Regency Inn, Denver, CO. Contact: Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.
- September 5-11: *World Congress on Medical Physics and Biomedical Engineering*, including the 13th *International Conference on Medical and Biological Engineering* and the 6th *International Conference on Medical Physics*, Congress Center, Hamburg, Germany. Contact: MPBE 82, Congress Organization, PO Box 302360, D-2000 Hamburg 36, Federal Republic of Germany.
- September 6-10: *7th Colloquium on Microwave Communication*, Budapest, Hungary. Contact: Secretariat of the 7th Microcoll, H-1525, Budapest 114, POB 15, Hungary.
- September 8-10: *International Symposium on Electromagnetic Compatibility*, Marriott Hotel, Santa Clara, CA. Contact: Dr. Andrew Nalbantian, 20617 Debbie Lane, Saratoga, CA 95070.
- September 20-21: *4th Annual Conference of the IEEE Engineering in Medicine and Biology Society*, Marriott Hotel, Philadelphia, PA. Contact: Dr. Alfred R. Potvin, Department of Biomedical Engineering, PO Box 19138, University of Texas, Arlington, TX 76019.
- September 20-22: *2nd Annual Meeting of the Bioelectric Repair and Growth Society*, Oxford, England. Contact: Dr. B.F. Siskin, Wenner Gren Research Laboratory, University of Kentucky, Lexington, KY 40506.
- September 22-24: *35th Annual Conference on Engineering in Medicine and Biology*, Marriott Hotel, Philadelphia, PA. Contact: ACEMB, 4405 East-West Highway, Suite 210, Bethesda, MD 20814.

MICRO WAVE NEWS



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A Monthly Report on Non-Ionizing Radiation

January/February 1983

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Microwave News invites letters from readers. We ask writers to be brief, and we reserve the right to edit contributions for length.

EPA Set to Close RF/MW Research Lab

The Environmental Protection Agency (EPA) is planning to close down the radio-frequency and microwave (RF/MW) radiation program at the agency's Health Effects Research Laboratory. EPA Administrator Anne Gorsuch did not request any funds for the program in her fiscal year (FY) 1984 budget, and unless Congress forces a change, all EPA research on RF/MW radiation will stop on September 30.

As this issue goes to press, the official budget has yet to be released by the President; nevertheless, most researchers contacted by *Microwave News* had already heard about the decision and expressed their dismay and disappointment. EPA staff refused to comment until the budget was made public.

The cut back comes at an inopportune time. EPA's Office of Radiation Programs (ORP) has just officially announced its intention to set a safety level, or "guidance," for public exposures to RF/MW radiation (see p. 3). The lab, which is part of EPA's Office of Research and Development (ORD) in Research Triangle Park, NC, was

EPA is not the only federal agency whose non-ionizing radiation program is in trouble: NIOSH has lost much of its staff as it closed its Rockville offices, and NTIA has let ERMAC's charter expire and has ended its role in coordinating federal RF/MW bioeffects research. See p. 2.

to have supported that effort. In addition, cuts in this year's (FY83) budget have already forced a reduction in many research programs at EPA and other federal agencies.

The RF/MW research group's FY83 budget is \$1.5 million, compared with \$2.12 million in FY82. ORP's budget, which includes both ionizing and non-ionizing radiation activities is slated to stay at its FY83 level, approximately \$10 million.

The EPA R&D effort represents about 15 percent of the federal budget for non-ionizing radiation research, of which more than 60 percent is controlled by the military, primarily by the air force and the navy.

EPA's research budget will be the subject of congressional hearings tentatively scheduled for March 2, 9 and 16 by the subcommittee on natural resources, agriculture research and environment of the House Committee on Science and Technology. Tony Clark, a consultant to the subcommittee, said "you can be assured that the budget cuts will be addressed at the hearing." Representative James Scheuer (D-NY) is the chairman of the subcommittee.

Last summer, Kathleen Bennett, EPA's assistant administrator for air, noise
(continued on p. 2)

Computer RFI

Many computer users are experiencing problems caused by radiofrequency interference (RFI). In the course of checking out these complaints, we have contacted a number of computer manufacturers; they respond that computer susceptibility to RFI is rare and not a general problem. We invite our readers to send us reports about specific incidents and solutions so that we can sort this situation out.

EPA to Close Lab (continued from p. 1)

and radiation, made a strong case for the continued funding of the RF/MW research group. In a memo to Courtney Riordan, the acting assistant administrator for R&D, Bennett argued that her staff at ORP would need the help of the health effects research team in the development of the public health guidance through FY89. Even once a public limit is issued in FY85, Bennett wrote, EPA will still have to address a number of important issues such as mechanisms, modulation, chronic exposures and frequency specific effects. (The full text of Bennett's memo appears below.)

Paradoxically, the announcement that the RF/MW lab is scheduled to be disbanded comes only a few weeks after a peer review committee issued a glowing assessment of its work. In its report, the committee wrote: EPA RF/MW research is "of high quality and is highly regarded by peers in the scientific and engineering community. The breadth of expertness in the division is impressive." They cite "the excellent leadership and scientific competence" of the acting head of the lab's division, Dr. Joe Elder. The committee's members were Professor Carl Durney of the University of Utah (chairman), Dr. Elliot Postow of the Naval Medical R&D Command and Dr. Don Justesen of the VA Medical Center in Kansas City, MO.

One of the projects to be terminated when the lab closes is Dr. Carl Blackman's experiments on the effects of ELF modulated fields on calcium efflux in the brain. The review committee singled out this work as being "of immense potential significance in the determination of safety standards and in establishing a sound scientific basis for such standards."

In a telephone interview with the members of the peer review panel, all three expressed their disappointment with EPA's decision. "We need that kind of research and I will be sorry to see it go," said Durney. "The whole area is headed for extinction unless something is done... I am alarmed," said Justesen. ●

Memorandum from Kathleen M. Bennett, Assistant Administrator for Air, Noise, and Radiation, to Courtney Riordan, Acting Assistant Administrator for Research and Development, on Non-ionizing Radiation Research Needs.

I am writing to document the research activities we will need from the Office of Research and Development (ORD) to support our regulatory program for non-ionizing radiation.

Over the next few years (FY84-85) we will be developing guidance to control the radiofrequency exposure of the public. We will need the continued support of the health effects research staff to evaluate new research results through the public comment period. More importantly, the guidance we are developing will not address such important areas as mechanisms, inhomogeneous absorption, modulation, population sensitivity, chronic low-level exposure and frequency specific effects. Research in these areas needs to begin now so that you can address these issues in a major revision of the health effects document in support of our reevaluation of the radiofrequency guidance in FY89.

We also need your assistance in reaching decisions on the need for regulation at frequencies not covered by the guidance we are now developing, i.e., for frequencies above 100 gigahertz (GHz) and frequencies below 10 kilohertz (kHz), especially at 60 hertz (Hz), the frequency used for high voltage power transmission. This is a critical area, since the trend is to higher transmission voltages and effects are now seen in animals at levels very near those produced by present transmission voltages. We need an evaluation of effects, definition of uncertainties, and research to resolve these uncertainties.

The technological advances in the use of the electromagnetic spectrum are rapid and to a great extent unpredictable. As the spectrum becomes crowded, pressures mount to move to higher and higher frequencies and different applications. We do not perceive that the issuance of guidance for

radiofrequencies in FY85 will reduce the support we need from ORD to make regulatory decisions at higher and lower frequencies or to reevaluate guidance for issuance in FY89. The health effects research staff is the only source of support we have tracking and evaluating research results and for conducting an integrated (intramural and extramural) research program to resolve important issues.

ERMAC Fades Away

The charter of the Electromagnetic Radiation Management Advisory Council (ERMAC) expired on January 9 and the National Telecommunications and Information Administration (NTIA), its parent agency, has made no move to renew it. NTIA head Bernard Wunder said that he has not yet decided ERMAC's future.

The agency did not request any money in its fiscal year 1983 budget for the coordination of federal research on the biological effects of non-ionizing radiation, bringing this work to a stop last October 1. Because no other agency has stepped forward to take over ERMAC from NTIA, the council may cease to exist.

Janet Healer, NTIA's program manager for non-ionizing radiation activities and an ERMAC member since its creation in 1968, has been temporarily assigned to other duties at NTIA.

ERMAC's sister committee, the Frequency Management Advisory Council (FMAC) will be renewed. Donald Jansky, associate administrator of NTIA and FMAC chairman has resigned to open up his own consulting firm. Jansky served as ERMAC's chairman at its last two meetings and had tried to find funds to allow its continued operation. ●

NIOSH in Disarray

The Rockville staff of the National Institute for Occupational Safety and Health (NIOSH) has dispersed. Just before Christmas, a congressional ban on moving NIOSH personnel out of the Washington, DC, area was revoked: employees were given 30 days to report to their new offices in Atlanta, GA, or Cincinnati, OH. Most refused to be reassigned. The resulting upheaval promises to further delay the completion of the institute's criteria document on radiofrequency and microwave (RF/MW) radiation.

NIOSH's criteria document development division was slated to go to the institute's laboratories in Cincinnati, OH. Of the three experts on non-ionizing radiation in Rockville, MD, Dave West has left to join the National Center for Devices and Radiological Health and Drs. Momtaz Wassef and Paul Strudler are believed to be resisting the move to Ohio. Neither could be reached for comment. Wassef had been the principal writer of the document; now that responsibility has been transferred to the Physical Agents Effects Branch, which has always been in Cincinnati.

When the move was first proposed two summers ago (see *MWN*, July/August 1981), there were some 152 employees in Rockville; by last Christmas only 60 remained—most of these will stay in Washington, DC. For example, only one of 24 members of the criteria development division has decided to go to Cincinnati. Many NIOSH staffers have found new jobs at the center or other parts of the Food and Drug Administration and the Department of Health and Human Services.

Senior NIOSH officials in Cincinnati are reevaluating plans for the RF/MW criteria document. They are weighing the possibility of changing course and releasing a much shorter report which could serve as rationale for a future RF/MW occupational exposure standard. A trimmed down document could be completed by this summer, reliable sources said, whereas there was practically no chance a complete criteria document could be finished this year with the present staff. ●

HIGHLIGHTS

EPA Moves Forward on RF/MW Exposure Guidance

The Environmental Protection Agency (EPA) has formally announced its plan to propose a "guidance" for general population exposure to radiofrequency/microwave (RF/MW) radiation in September. EPA officials already have a working number for the limit, though they do not plan to reveal it for some time.

Observers are confident that the number will be somewhere between the 50 $\mu\text{W}/\text{cm}^2$ standard proposed in New York City and the new American National Standards Institute's 1,000 $\mu\text{W}/\text{cm}^2$ recommended guideline. Specifically, many are betting on 200 $\mu\text{W}/\text{cm}^2$, which Massachusetts has proposed.

When final, the "guidance", unlike a standard, will only apply to federal agencies and their facilities. As the first national limit for public RF/MW exposure, however, its importance will far exceed its legal reach. Last year, the Federal Communications Commission (FCC) announced it will use EPA's number in determining whether proposed broadcast sources seeking licenses pose health hazards. (See *MW*, March and September 1982.) The guideline will not cover occupational exposures or emissions from consumer products which, according to EPA, can be "more easily controlled" through performance standards.

The group at the Office of Radiation Programs (ORP) has finished a working draft of the guidance and plans to circulate it for inter-agency review this month. The office sent out letters in January requesting that interested federal agencies each appoint a staffer to participate in this preliminary evaluation.

The agency's Office of Research and Development (ORD) has prepared a draft criteria document on RF/MW bioeffects, which will serve as the basis for the guidance. The report is scheduled for public release in March when it goes to the Scientific Advisory Board (SAB) for review. The agency is now setting up a special panel to advise the SAB. Reliable sources say Professor Charles Susskind of the University of California, Berkeley, will be asked to chair the group. (By law, EPA must also consult the National Council on Radiation Protection and Measurement and the National Academy of Sciences on the guidance.) The publication of the criteria document is tentatively scheduled to coincide with release of the agency's notice of proposed recommendation in September.

Another support document, an economic impact study by the Environmental Sciences Division at the Department of Energy's Lawrence Livermore National Laboratory in Livermore, CA, should be completed by early summer.

The communications industry has been anxiously awaiting a national guideline on RF/MW radiation as proposed broadcast sources have met increasing opposition from community groups. Comments submitted last year on FCC's proposed RF/MW rules reflect industry fears over restrictive state and local standards.

EPA field measurements indicate most ambient radiation levels fall below even the strictest possible guideline. Based on readings from 15 cities, EPA estimates that over 99 percent of the population is exposed to RF/MW fields of less than 1 $\mu\text{W}/\text{cm}^2$. The median residential exposure is 0.005 $\mu\text{W}/\text{cm}^2$ at FM radio and TV frequencies (up to 806 MHz) and 0.019 $\mu\text{W}/\text{cm}^2$ at AM radio frequencies. These bands are "the principal contributors to the general radiofrequency environment." Above 806 MHz, exposures are estimated to be "much less than 1 $\mu\text{W}/\text{cm}^2$ for most of the population." (The agency has asked for comments on what frequencies the guidance should cover.)

For people living near high power transmitters, exposures can be "considerably higher"—as high as 5,000 $\mu\text{W}/\text{cm}^2$ in localized areas—according to EPA. Measured levels near FM broadcast antennas reported in the notice go as high as 350 $\mu\text{W}/\text{cm}^2$ in a resi-

dential neighborhood and 97 $\mu\text{W}/\text{cm}^2$ in a tall office building. Exposures "in the range of 10 to 100 $\mu\text{W}/\text{cm}^2$ can occur at distances up to 0.5 miles from some radar systems and satellite communication earth terminals."

The agency lists five key areas it will consider in establishing limits, including: 1) mechanisms of interaction, 2) possible thresholds of effects, 3) reversibility of effects, 4) dependence of effects on duration of exposure and 5) whether biological effects adversely affect human health. It provides few clues, however, as to what types of exposure may be unsafe. The agency does cite Eastern European reports of behavioral and nervous system effects at levels below 1 mW/cm^2 , but then qualifies that this "limited clinical data suggest that these effects are reversible."

As for the key question regarding public safety, the agency only states, "It is not known whether the long-term, low-level exposures received by the general population can lead to irreversible adverse health effects, overt clinical disease, or whether adaptation can occur."

EPA is now awaiting comments on the scope and approach the guidance should take. The specific questions it wants addressed are listed below. Comments on the advanced notice (47 FR 57338, December 23, 1982) are due by February 22 but ORP's Norbert Hankin admits that he expects to receive some late replies. The agency will hold public hearings after the release of the proposed guidance.

Questions Posed by EPA

We specifically request comment on the following:

1. What conceptual approach should be used to develop limits for exposure? Examples of some possible approaches for establishing exposure limits include:

- (a) Threshold for biological effects.
- (b) As low as reasonably achievable.
- (c) Limit risk to a level comparable with that for other environmental pollutants.

(d) Use of best available or best achievable technology.

2. What range of frequencies should be included in the guidance?

3. Should different guidance be developed for partial-body and whole-body exposure?

4. Should the exposure limits take into account the fact that the rate of energy absorption varies with frequency?

5. Should limits be placed on maximum as well as average exposure?

6. Should limits be placed on instantaneous as well as time-averaged specific absorption rates?

We would appreciate comments on these questions and identification of other issues that should be considered in the development of this guidance. ●

Canadian Group Recommends Limits for VLF Radiation from VDTs

A Canadian advisory group has recommended extending radiation standards to include the very low frequencies (VLF) emitted by some video display terminals (VDTs). In a statement issued in January, scientists at the Canadian Center for Occupational Health and Safety (CCOHS) say that although there is no known link between VDT exposure and reported reproductive problems, a cautious approach demands reducing emissions through shielding or terminal redesign until present uncertainty is resolved.

The center recommends that, on an interim basis, exposures to non-ionizing radiation from VDTs be limited to 60 V/m, as measured 30 cm from the set, for frequencies above 10 kHz. In Canada, a 60 V/m limit is already recommended by the province of Ontario for frequencies down to 300 kHz and by the federal government for frequencies down to 10 MHz. No standard in either the US or Canada now covers the 10-300 kHz band, though the

American Conference of Governmental Industrial Hygienists (ACGIH) has proposed limiting exposures to 614 V/m between 10 kHz and 3 MHz. The new American National Standards Institute (ANSI) standard does not recommend safety levels for frequencies below 300 kHz.

In considering possible causes for eight clusters of miscarriages and birth defects reported among VDT Operators (see *MWN*, July/August 1982), CCOHS scientists contend that "the weight of the scientific evidence is against ionizing radiation" because most VDT surveys show "negligible" X-ray emissions. Instead, they are looking to the pulse-modulated VLF fields produced by VDT flyback transformers.

Although the presence of VLF fields is widely acknowledged, most experts do not believe they are biologically active. CCOHS is focusing attention on the pulsed nature of these emissions because "pulse-modulated fields could be biologically more harmful than [unmodulated] fields." This is the first explanation, other than chance, for the clusters.

The center's Dr. Karel Marha cautions that research on the specific fields associated with VDTs must still be done. Nevertheless, he says the results of experiments with related pulsed fields provide a basis for concern. Czech researcher Dr. Hana Pafkova, for example, exposed pregnant mice for 17 days to a pulsed 300 Hz field with a peak value of 28,500 V/m and a pulse width of 10 microseconds and found "an unfavorable effect" on embryonic development. (Published in *Pracovní Lékarství*, (*Occupational Medicine*) 32, 334, 1980, written in Czech with an English abstract.)

In a telephone interview with *Microwave News*, Marha pointed out that the time-averaged field used by Pafkova was actually about 85.5 V/m, a level he called "not very high." He stressed that no one knows whether there is a radiation problem, but added, "if something is going on, these fields could be responsible."

The center's recommendation to limit these exposures drew sharp criticism from the Canadian Business Equipment Manufacturers Association in Toronto. In a telex sent January 10, the association's general manager Jim Flood warned the center that its statement would only create needless concern among VDT users and asked that it be withheld. According to Flood, "the center has proposed solutions to problems that don't exist: there is no evidence indicating VLF radiation is a hazard."

CCOHS scientists say only research, ranging from mathematical modeling to animal testing, will resolve the radiation issue and urge that this work be started. Noting that epidemiological studies are either underway or planned, they warn that there are too many confounding factors in this type of research to provide any clear-cut answers.

Marha has prepared a short paper, *The State of Knowledge Concerning Radiations From Video Display Terminals*, which reviews the types of emissions from VDTs. CCOHS is located at 250 Main Street East, Hamilton, Ontario, L8N 1H6, Canada. ☐

NBS Designs New Meter to Measure E- and H-Fields Simultaneously in Near Field

Researchers at the National Bureau of Standards (NBS) have shown the theoretical feasibility of building a meter that can measure electric and magnetic fields *simultaneously* in the near field. Preliminary experiments, run at 100 MHz, indicate that the theory is correct. NBS' Dr. Moto Kanda said that a fully designed meter should be available within two years.

A sensor capable of measuring both electric and magnetic fields at a given point would represent a significant breakthrough—with widespread applications in the biological effects and radiofrequency interference communities. At present, there is no quick and reliable way of characterizing the components of low frequency (below 300

MHz) electromagnetic fields, which have extensive near fields.

Speaking from their laboratory at NBS' Electromagnetic Fields Division in Boulder, CO, Moto Kanda and Frank Ries said that, in the months ahead, they plan to design an isotropic antenna, to establish a flat frequency response for broadband measurements and to develop a fiber optic link so that the new sensor would not perturb the field.

Once the research and development is completed, NBS will disclose the meter's design to encourage the private sector to manufacture and market it. Kanda and Ries said that a number of companies have already expressed interest in the new meter.

Kanda is scheduled to describe the theoretical basis for the sensor in a paper to be presented at the *Electromagnetic Compatibility Symposium* to be held in Zurich, Switzerland, in early March. ☐

Wertheimer Extends Cancer Study to Adults

Dr. Nancy Wertheimer and Ed Leeper have extended their 1979 work on childhood cancer and 60 Hz fields to adults: they have identified a "highly significant" association between the incidence of adult cancer and alternating magnetic fields (AMFs), though it was "considerably weaker" than the association observed for children. They contend that prolonged exposure to AMFs may promote the development of cancer.

While admitting that epidemiologically derived results can always turn out to be artifactual, the Colorado researchers argue that the association between cancer and the presence of high current electrical distribution lines may be a causal link because: "(1) a dose-relationship was observed; (2) two different control procedures yielded essentially similar results; (3) the strength of the associations observed in different age, urbanicity and socioeconomic groups was consistent with a causal interpretation; (4) a distinct pattern of latency between first exposure to the [high current configurations] and cancer diagnosis was seen, which is consistent with a hypothesis of cancer promotion produced by [exposure to AMFs]."

Wertheimer and Leeper maintain that the stronger association with children relative to adults may not indicate that children are more susceptible to the effects of AMFs—rather that any increase in cancer rates would show up more clearly in a population with a low incidence of cancer such as children.

In recent months, there have been three other reports connecting extremely low frequency (ELF) radiation to cancer. Studies from Washington state and California have found indications that workers exposed to electromagnetic fields have a greater risk of developing leukemia (see *MWN*, July/August and December 1982). And a Swedish team found support for Wertheimer and Leeper's 1979 results among Stockholm residents exposed to 50 Hz fields (see *MWN*, November 1982).

"Adult Cancer Related to Electrical Wires Near the Home" appears in the *International Journal of Epidemiology*, 11, 345, 1982. Wertheimer is with the Department of Preventative Medicine and Community Health at the University of Colorado Medical Center in Denver. ☐

ITT Settles Engell Suit

Attorneys for ITT and Robert Engell agreed to an out of court settlement on December 23. Engell had filed a \$4.5 million claim alleging that he had developed pancreatic cancer due to radiation exposure from tactical air navigation (TACAN) equipment manufactured by ITT. None of the attorneys involved would divulge the amount of the settlement, though one source did remark that more than nuisance money is involved.

Marc Moller and Michael Young, two of Engell's attorneys at the New York City law firm of Kreindler & Kreindler, said that they

were pleased with the outcome in the light of the present state of knowledge on radiation injuries. They said that Engell is satisfied. Matthew Shafner of O'Brien, Shafner, Garvey, Bartnik & Stuart of Groton, CT, was co-counsel on the case.

ITT was represented by John FitzGerald of the Hartford, CT, firm of Howard, Kohn, Sprague & FitzGerald; he refused to discuss the settlement.

A jury had been selected and the trial was scheduled to begin on January 5 in US District Court in Hartford. Engell's original suit, filed in 1977, named General Dynamics, Raytheon, Rockwell International and Varian Associates as co-defendants along with ITT. All four companies settled out of court in November; those agreements also stipulated that the settlements be kept confidential.

Engell worked at the Naval Air Rework Station on Quonset Point, RI, from 1965 until it was closed in 1973. He and one of his co-workers, Donald Cadieux both developed pancreatic cancer. More specifically, Engell had nonbeta islet cell cancer of the pancreas while Cadieux had adenocarcinoma of the pancreas. Cadieux died

in October 1974; his widow's claim of wrongful death was barred under the Rhode Island statute of limitations.

One medical opinion, solicited by Engell's attorneys and placed in the court's records, states that "to find two men under 40 to have contracted pancreatic cancers in the same place is so highly unusual as to invite the inference that the disease states in each of them was occupation related." The expert was Dr. Leonard Dauber, an assistant clinical professor of medicine at Albert Einstein College of Medicine in New York City.

ITT never acknowledged that TACAN radiation caused the cancer; but, according to Young, the company filed papers with the court admitting there were no warnings of potential radiation dangers on the equipment when Engell worked on it. Among those listed as experts for ITT were: Drs. Don Justesen, Sol Michaelson, John Osepchuk, and Paul Tyler.

TACAN operates at frequencies of 1.025-1.213 GHz. In addition, the men were probably exposed to X-ray radiation from the rectifier tubes in the high voltage power supply. ●

UPDATES

Biological Effects . . . Dr. Carl Blackman and his colleagues at EPA published their latest findings on ELF-induced calcium efflux from brain tissue in the December *Radiation Research*. As Blackman reported at last summer's BEMS conference (see *MWN*, July/August 1982), the EPA group used 16 Hz sinusoidal fields *without* a carrier wave and found two power windows of enhanced efflux at 5-7.5 V/m and 35-50 V/m. These results are similar to those obtained with 50 and 147 MHz carrier waves modulated at 16 Hz, leading them to the conclusion that the RF carrier is not the responsible agent. They write that the experiment provides: "strong evidence against any potential mechanism of action that invokes generalized heating as the underlying cause." Blackman's findings disagree with those of a similar experiment run some years ago by Drs. Suzanne Bawin and Ross Adey. While both groups identified the same frequency specificity, Bawin and Adey found a reduction in calcium efflux while the EPA researchers found an enhancement—a difference that remains unexplained. At the 1982 BEMS meeting, Blackman said that he planned to see if higher ELF frequencies affected calcium mobility. In a telephone interview, Blackman said that he is in the process of running experiments at frequencies of up to 120 Hz. He predicted that he would have some results for the 1983 BEMS meeting, which will be held in Boulder, CO, in mid-June. . . . Professor Bill Guy will also be in Boulder to present the near-final results of his multi-million dollar, long-term study. Guy's research team at the University of Washington, Seattle, turned off the power last September after exposing 98 rats to 2450 MHz, 8 Hz pulsed microwaves for 36 months. The statisticians are still at work, Guy told *Microwave News*, but the preliminary indications are that there were no significant differences between the exposed and control animals. At last year's BEMS meeting, there was a paper out of Guy's lab indicating there might be some changes in T and B cells among the rats exposed to microwaves, but these were not confirmed by later tests. Guy said that he would like to do some more work on the effects of radiation on the immune system as well as the metabolic changes that follow irradiation. Now that the experiment is over, Guy intends to design improved applicators for hyperthermia treatment. . . . Another, though less ambitious, chronic study is reported by two Canadian researchers in the second issue of *Journal of Bioelectricity*, published by Marcel Dekker. Dr. J. A. Tanner of the National Research Council of Canada in Ottawa and Dr. C. Romero-Sierra of Queen's University in Kingston, exposed a colony of leghorn chickens to 7.06 GHz CW from a four-foot parabolic dish for more than 200 days: field intensities ranged from 0.19 uW/cm² to 360 uW/cm² depending on the location of the cage with respect to the dish. Microwaves increased egg production by 13 percent over the controls but was accompanied by double the mortality rate—mostly from avian leukosis and tumors in the central nervous system. In addition, the birds that survived showed a pronounced deterioration in health. The authors explain these adverse effects at such low levels with the hypothesis that "high intensity fields trigger thermal effects that block the non-thermal effects identified with low intensity fields." . . . Meanwhile scientists at the Battelle Northwest Laboratories have been investigating the

effects of magnetic fields on trout. Battelle's Dr. John Strand reports that "fertilization was enhanced when ova and sperm of rainbow trout were exposed to a 1-tesla magnetic field before fertilization." A number of other magnetic field studies are also underway at the lab; to date, no adverse impacts have been detected. . . . As anticipated, ONR has picked up the abstracting of the bioeffects literature from NTIA. The BENER (Biological Effects of Non-Ionizing Electromagnetic Radiation) digests will continue to be prepared by Bruce Kleinstein under a newly created company, Information Ventures. Kleinstein, who is based in Philadelphia, PA, has received a one-year \$72,000 contract, renewable for two more years, to prepare a quarterly review of the world's bioeffects research. The digest will pick up where NTIA left off; the first issue will begin with January 1982. If renewed, the total contract will be worth \$212,000. . . . The research group at the University of Utah continues to turn out a large number of papers. Two recent additions were published in the November *IEEE Transactions on Microwave Theory and Techniques*: Professor Om Gandhi presents a review of the bioeffects and medical applications of RF/MW fields and, with two of his colleagues, some results on radiation absorption in the near field. . . . The most recent contribution to the debate on the potential hazards of fluorescent lights appeared in the November 27 *Lancet*. Dr. Robert Stern of Harvard Medical School contends that the increased risk of melanoma associated with fluorescent light in a recent study (see *MWN*, September and December 1982) is likely to reflect a bias in the selection of controls rather than a true risk. . . . Professor Albert Krueger died in December at the age of 80. Krueger, who spent much of his career at the University of California, Berkeley, was a leading researcher on the biological effects of air ions.

Communications . . . MCI Communications Corp. is bullish on fiber optics. Since November the company has purchased rights-of-way for over 4,000 miles of cables, including the Washington, DC, to New York City corridor. MCI chairman William McGowan says the east coast link will boost transmission capacity at a cost that is "far more economical" than expanding the company's existing point-to-point microwave network. The new technology, which is digital, can also improve transmission quality because it is immune to interference. . . . Meanwhile, ITT continues its efforts to site a point-to-point tower in northern New Jersey, one link in a planned network between Newark and Boston. A permit application was rejected by South Nyack, NY, last year and the company is now seeking approval in Ringwood, NJ, for the tower. In a January 21 release addressing community concern over potential radiation hazards, the company said the calculated power density at the base of the tower would be 0.02 uW/cm². . . . The organizers of the community group opposing RCA's application for an additional point-to-point station at its satcom facility in Vernon, NJ, (see *MWN*, November 1982) showed up at Ringwood's January public meeting on the ITT tower. RCA came too. . . . The November 1982 issue of the *Proceedings of the IEEE* is devoted to UHF-TV. . . . Telex Communications' Hy-Gain divi-

sion has issued a catalog of commercial, industrial and military HF, VHF and UHF antennas. For a copy, write to Hy-Gain, CIM Department, 8601 NE Highway Six, Lincoln, NE 68505. . . . Next year, your car radio might belt out the top 40 in stereo. Delco Electronics, a division of General Motors and the largest US maker of car radios, has decided to use Motorola's system for AM stereo radio. This is a major break in the standoff among three non-compatible systems hoping to win market acceptance. Harris Corp. and Magnavox are the losers in this round.

Compatibility & Interference. . . The FCC has closed its books on a notice of inquiry, adopted in December 1975, to investigate possible interference from spark-type ignitions to communication systems. In a memorandum, opinion and order released January 4, the commission states that there is little justification for pursuing the matter because the incidence of RFI from spark-type ignitions is decreasing and will probably continue to do so. . . . Video games, on the other hand, are another story. In mid-December, the AP featured a story about RFI complaints at a fire company in Milford, DE. Two video games had to be removed from the firehouse because they were interfering with land mobile units in the firetruck and confounding the transmission of alerts to the firemen's homes. The video game RFI problem may get worse after Christmas, according to an FCC staffer quoted by the AP, when all those games come out from under the trees. . . . The Army Aviation R&D Command and NBS are planning a five-year effort to improve the army's EMC measurement program for helicopters, light aircraft and remote-piloted vehicles. The EMC program will include an assessment of shielding materials and military standards 461 and 462, as well as a study of the feasibility of establishing a government high-field-strength EMC test facility and a study of improved methods for electromagnetic pulse testing. . . . The FAA has signed a contract with the Department of Electrical Engineering at Ohio University in Athens to measure radiated emission from ISM equipment at an open field test site and at the actual location where the ISM equipment is operated. The FAA wants field strength measurements in the air over the ISM devices at a minimum of three different altitudes above the test site. . . . The Energy and Environment Division of the Lawrence Berkeley Laboratory at the University of California has issued the *Proceedings of the Lighting-Electromagnetic Compatibility Conference*, held at the lab last March 18-19. A limited number of copies of the report (No. LBL-15199) are available from Dr. Rudy Verderber, Lighting Systems Research Group, LBL, Berkeley, CA 94720. Afterwards, it will be available from the National Technical Information Service, Springfield, VA 22161.

EMP. . . Concern over the possible impact of electromagnetic pulse (EMP) radiation on communications and energy systems continues to grow. While DOD has budgeted a major effort to protect vital military communication links from EMP disruptions, Edward Teller is worried about the EMP threat to industry. Writing in the October issue of the *IEEE Spectrum*, Teller speculates that in the event of heavy EMP radiation "it would be easier to enumerate the apparatus that would continue to function than the apparatus that would stop." Teller calls for the declassification of essential DOD documents because, unless precautions are taken, "the civilian economy faces the prospects of grinding to a halt in a nuclear encounter." With respect to the effects of EMP on electric power systems, a number of studies are already underway: the Zaininger Engineering Co. is characterizing EMP coupling and interactions for the Oak Ridge National Laboratory (Zaininger has sub-contracted research on EMP effects on three phase circuits to the Dikewood Corp. and on magnetohydrodynamic-EMP surges on long transmission lines to the Mission Research Corp.) The Boeing Co. is looking at the effects of EMP on power system components for the Defense Nuclear Agency (DNA); DNA is also sponsoring the development of an advanced arrestor for EMP from surface nuclear bursts at General Electric. The Nuclear Regulatory Commission has contracted with Sandia National Laboratory for a major study of the effects of EMP on nuclear power plant safety systems; other related studies are planned. (Preliminary results from Sandia indicate that safety systems should not be damaged.) Most recently, Union Carbide, which runs Oak Ridge for DOE, has issued a RfP (No. 19-4456) for an assessment of the effects of EMP on utility electric power systems and for recommendations on how they can be protected. . . . Much of the public awareness of EMP is attributable to articles by William Broad in *Science* and Janet Raloff in *Science News*. Broad has now written a popular piece, "The Chaos Factor," which is the cover story in the January/February issue of *Science* 83. Broad recently left *Science* to join the *New York Times*. . . . A comparison

of electromagnetic fields (in the frequency range 10^4 - 10^7 Hz) from nuclear EMP with those from lightning appears in the November issue of the *IEEE Transactions on Electromagnetic Compatibility*.

Government. . . Bruce E. Fein has been appointed general counsel at the FCC. Fein comes to the commission from the Department of Justice. . . . FDA has renewed the charter of its Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) for two more years. The date of the committee's next meeting has not been announced.

International. . . The Industrial Injuries Advisory Council in London, UK, is reviewing occupational risks associated with exposure to electromagnetic fields, including ionizing and non-ionizing radiation. For more information contact the council at Friars House, 157-168 Blackfriars Road, London SE1 8EU. . . . Visiting Chinese scientist Zhi-Yuan Shen reports that the *Third National Symposium on Microwave Power Applications* will be held in China later this year; the exact date and place of the conference have yet to be decided. With respect to medical applications, he said that needles are being used as antennas to transmit microwaves in acupuncture treatments in Chinese hospitals. The needles transmit 1 GHz radiation. . . . Howard Bassen and John Monahan of the National Center for Devices and Radiological Health left for the Soviet Union in mid-January as part of the joint US-USSR research program on non-ionizing radiation (see *MWN*, July/August 1982). Bassen will be checking dosimetry at Dr. Mikhail Shandala's lab in Kiev, while Monahan will review the experiment's behavioral protocols. Afterwards, Monahan will visit other labs in Moscow and Leningrad.

Measurement. . . NBS has issued three new publications: (1) a new edition of its catalog, *Calibration and Related Measurement Services of the National Bureau of Standards* (SP 250-1982), which includes a special appendix listing contacts and prices for each service. It is available for \$6.00 prepaid from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Stock No. 003-003-02446-5. The appendix is updated every six months free of charge; (2) *Metrology for Electromagnetic Technology: A Bibliography of NBS Publications* (NBSIR 82-1677). This volume, which covers papers and reports published by the bureau's Electromagnetic Technology Division staff between 1970 and 1981 on microwave circuits and pulsed electromagnetic phenomena among many other subjects, can be purchased for \$9.00, prepaid, from the National Technical Information Service (NTIS), Springfield, VA 22161. Order No. PB 83-111658; (3) *Bibliography of the NBS Electromagnetic Fields Division Publications* (NBSIR 82-1673) lists the division's 1980-81 reports on measurement methods and standards as well as antenna systems and RFI. Available from NTIS for \$6.00. Order No. PB 83-119776. . . . A session at the *1983 Measurement Science Conference* held in Palo Alto, CA, January 20-21, featured three papers on automated testing techniques for microwave technology. Algio Lance of TRW Systems in Redondo Beach, CA, organized the session and presented one of the papers; the other two were by Mike Cuevas and John FitzPatrick, who both work at Hewlett-Packard. For more information, contact Lance at (215) 535-5167.

Medical Applications. . . A hyperthermia unit manufactured by BSD Medical Corp. of Salt Lake City, UT, failed to receive premarket approval (PMA) from the FDA at a December 8-9 Radiologic Devices Panel meeting in Rockville, MD. An evaluation by officials at FDA's National Center for Devices and Radiological Health recommended approval for the cancer treatment unit with respect to safety and engineering, but there were some doubts about the machine's efficacy due to insufficient statistical controls in the submitted clinical data. BSD presented results from treatments with radiation and hyperthermia but not with radiation alone. Dr. J. William Dirksen, director of research and regulatory affairs at BSD told *Microwave News* that the company was in the process of generating the necessary data and that the company would resubmit the PMA application in early February. In 1981, Henry Medical Electronics' Magnetron unit also failed to clear PMA (see *MWN*, May 1981). To date no hyperthermia device can be marketed to treat cancer. . . . At the same meeting, there was discussion, initiated by the National Electrical Manufacturers Association (NEMA), on the possibility of changing the classification of NMR imagers from Class III to Class I or II, which do not require PMA. The panel expressed its interest in reclassification, but advised that it was up to NEMA to take formal action by filing a petition. In an interview, NEMA's Robert McCune said the group

was in the process of polling its member companies on the merits of such an action. . . . The National Cancer Institute (NCI) has set up a new committee, the Cancer Therapeutics Program Project Review Committee to advise NCI staff on "the merit review of applications requesting support for clinical and laboratory program project proposals." . . . In the latest issue of the *Journal of Bioelectricity* (Volume 1, Number 2, 1982), Drs. Stephen Smith and Jose Feola of the University of Kentucky College of Medicine report on experiments designed to see whether the pulsed magnetic fields used to heal nonunion fractures affected the course of malignant tumor development. They used a pulse generator made by Electro-Biology (which also supported the research) that emits a 5 millisecond train of 29 pulses, repeating at 15 Hz, inducing a peak magnetic field of about 20 gauss—an average field of 2–3 gauss. They found the magnetic field had: (1) little effect on survival, though there was a slight trend towards reduced survival; (2) a "quite remarkable" effect on internal organs; and (3) a general trend "towards the inhibition of the tumor and suppression of metastasis." As the authors themselves note, the results present "an interesting picture, not altogether easy to interpret." . . . In the same issue of the *Journal of Bioelectricity* Dr. Robert Becker, who recently retired from the Upstate Medical Center in Syracuse, NY, presents a review of "Electrical Control Systems and Regenerative Growth." . . . A group from Aberdeen, Scotland has used NMR to examine six patients in the first trimester of pregnancy, prior to termination. They report in the January 1/8 *Lancet* that the "fetal detail displayed by NMR is greater than that seen by ultrasound" and that there appear to be "no short or medium term side-effects." They caution, however, that "there is insufficient information from animal work about [NMR imaging's] mutagenicity to advocate the use of NMR in human pregnancy at this time." . . . Other recent NMR articles include a description of NMR imaging at Hammersmith Hospital in London in the November issue of *Radiography*, and "NMR Spectroscopy of Living Cells" by R.G. Shulman of Yale University in the January *Scientific American*. . . . IBM Instruments has agreed to help advance NMR imaging with grants of \$1.9 million to Harvard Medical School's Brigham and Women's Hospital and \$1.5 million to MIT's National Magnet Lab. . . . Clini-Therm Corp. of Dallas, TX, will do R&D on cancer treatment for Hyperthermia Associates of Nashville, TN, under a \$440,000 contract. . . . Dr. Margaret Patterson has developed a "black box" that sends weak electrical signals into the brain to help addicts kick the habit. Her NeuroElectric Therapy works for drugs, alcohol and cigarettes. In a detailed article in the January *Omni*, Kathleen McAuliffe describes the box and Patterson's remarkable success rate. Interestingly, Patterson found that different frequencies helped different addictions: 75–300 Hz for narcotics and sedatives, lower frequencies for barbiturates and approximately 2,000 Hz for cocaine and amphetamines. Patterson claims that her treatment does not cause any compensating "electronic addiction."

Ovens . . . A total of 4.07 million microwave ovens were shipped in 1982, down 7.9 percent from 1981, the record year for the industry. Despite the decline, sales have nearly doubled during the last five years. The Association of Home Appliance Manufacturers (AHAM), which compiles these statistics, believes that the future will be rosy: it points out that only one in four homes now has a microwave oven. . . . DOE has decided that energy efficiency standards for ovens, ranges and clothes dryers are not worth setting. In a final rule published in the December 22 *Federal Register* (47 FR 57198), the agency finds that such standards "would not result in a significant conservation of energy and would not be economically justified." When DOE first proposed a "no standard" approach, some congressmen voiced their displeasure (see *MWN*, June 1982). This time, Congress was in recess for the Christmas holidays and the rule passed relatively unnoticed. . . . Rubermaid has introduced a line of microwave cookware made of a new material it calls "Micrel." The company claims the products are "virtually unbreakable and won't warp, even with drastic temperature changes from freezer to microwave oven to dishwasher, where it is bottom rack safe." . . . Magic Chef plans to introduce a new line of microwave ovens at the end of January.

Power Lines . . . The Minnesota Environmental Quality Board (MEQB) has concluded that the state's construction permit for the Cooperative Power Association-United Power Association 800 kV DC power line is adequate to protect public health and safety without modification. In its December 21 ruling, the board did order continued monitoring of the electrical environment around the line, however, and asked the Minnesota Department of

Health to investigate the potential interference hazards of a line converter station to pacemakers. The board decision on the line running from a North Dakota coal field to Minneapolis/St. Paul, MN, follows the recommendations of its scientific advisory panel. The panel states in its report that "no additional standards are needed for safe operation of the line," though it also says that resolution of power line health effects issues "will definitely require well defined and replicated epidemiological studies," which in turn require more research on air ion concentrations. The advisors conclude that "the likelihood of long-term biological effects from the air ions generated by the line is considered to be low. However, we have virtually no direct information from any long-term studies of air ion effects." (See *MWN*, October and December 1982.) MEQB also reviewed a dairy cattle study by researchers at the University of Minnesota and reports on the state's program monitoring the electrical environment around the lines. For information on the availability of the reports, contact George Durfee, Manager, Power Plant Siting Program, MEQB, 15 Capitol Square Building, 550 Cedar Street, St. Paul, MN 55101.

Satellite Communications . . . The draft environmental impact statement (EIS) for Teleport, a satellite communications complex planned for Staten Island, NY, was released by the New York City Development Corp. and the Port Authority (PA) of NY and NJ on January 3. The facility would include 17 satellite antennas and eventually employ over 7,000 people. According to the draft, radiation levels near Teleport are not expected to exceed 3 uW/cm²—well below the 50 uW/cm² limit proposed as a population standard for New York City. Summary information in the EIS indicates safeguards in the project's design and operation would include continuous radiation monitoring and an alarm system, with an automatic cut-off, activated if radiation levels exceed 50 uW/cm². The facility would be surrounded by some form of wall to shield its antennas from external interference and to reduce RF/MW levels outside the site. Dr. Paul Tyler of the Defense Nuclear Agency reviewed the bioeffects literature for the statement, which concludes that "no hazardous conditions have been identified at the power density levels (maximum 3 uW/cm²) and radio frequencies (4 to 14 GHz) proposed for use" at Teleport. (Details are presented in a technical support document, *The Teleport Electromagnetic Energy Study*, 1982, by Ammann & Whitney, which was not yet available in late January.) Both Teleport, sponsored by the PA and Merrill Lynch, and an all-office development plan are considered in the EIS. A hearing on the project before the NYC Department of Environmental Protection and the NYC Planning Commission is scheduled for February 2. (See *MWN*, June 1982.) . . . RCA Americom's request to build a satcom station in the Indianola-Kingston area, near Seattle, WA, was denied by the Kitsap County Board of Commissioners for the second time on January 24. Company plans to site the facility on the county's Bainbridge Island and later in a forest near Kingston have met strong community opposition. Commenting on the ruling, Americom spokesman John Williamson said the company "will not pursue the Kitsap proposal at the present time," though "we still plan to start serving the Seattle area in 1983, from one location or another." The board refused RCA's application last year but was asked to consider it again after the company filed suit in state court (see *MWN*, December 1982). . . . A state superior court judge for nearby King County, WA, denied a citizen's group petition to block completion of Alascom's satcom station on Vashon Island. Members of Vashon for Quality Environment are likely to appeal the January decision to a higher court (see *MWN*, December 1982). . . . The UN General Assembly has approved a resolution barring direct satellite transmissions across national borders without the receiving country's consent. The December 10 vote followed the endorsement of the measure by a UN special political committee in November. . . . *The Satellite Communications Market in Western Europe*, a 383-page report from Frost & Sullivan, includes estimates for various sectors of this market totalling over \$8.5 billion by 1992. Report No. E564 costs \$1,600 and is available from the company at 106 Fulton Street, New York, NY 10038, (212) 233-1080.

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SHORT COURSES

VDTs... The Labor Education and Studies Center of the Canadian Labor Congress (CLC) has recommended in-depth studies to determine whether VDTs pose radiation risks. Citing concern over PCB's as well as very low frequency radiation, the center also urges that "long-term studies into reproductive hazards be undertaken immediately." The recommendations are included in its 241-page report on VDTs, which covers mainly non-radiation issues. A center survey of 2,330 Canadian workers found no evidence linking cataracts or reproductive problems to VDTs, but it cautions that only a study following a large group of workers over a long period could give conclusive results. The full report, *Towards a More Humanized Technology*, is available for \$20, and a 46-page digest for \$5, from the Center at 2841 Riverside Drive, Suite 301, Ottawa, Ontario, K1V 8N4, (613) 731-3052. . . . The Labor Council of Metropolitan Toronto reviews the CLC report in a special issue of its *VDT Newsletter* to be released this month. The council is also planning a conference on stress associated with VDT work on April 30. For information, contact the Council's VDT Committee, Room 407, 15 Gervais Drive, Don Mills, Ontario. . . . Several state legislatures may consider action on VDTs this year. In New York, a draft VDT safety bill sponsored by Brooklyn Assemblyman Frank Barbaro should be finished this month. And bills for establishing committees to investigate VDTs and possibly recommend legislation have been prepared by Connecticut's Committee on Labor and Public Employees (Study Bill 5132) and by Massachusetts' Committee on Commerce and Labor. VDT legislation proposed last year in Massachusetts (House Bill 2910) never reached the floor. (See *MWN*, April, 1982.) . . . NIOSH will investigate the relationship between stress and VDT work during an eight month study headed by Dr. Lawrence Scheifer at its laboratories in Cincinnati, OH. About 30 typists will participate. The project is not connected with two ergonomics studies now starting up under NIOSH's Dr. Michael Smith. (See *MWN*, December 1982.) . . . The North Carolina Occupational Safety and Health Project has asked interested union locals in the state to participate in a VDT worker survey on stress, ergonomics and potential reproductive problems. Contact Tobin Lippin, NCOSH, Box 2514, Durham, NC 27705. . . . Reports on new office technology appearing in the International Labor Organization's (ILO) *Social and Labor Bulletin* have been compiled and republished. The ILO book covers reports appearing since 1979 from a number of countries on such topics as general policy issues, labor relations and collective agreements, trade union viewpoints and the working environment. The 174-page *New Technologies: Their Impact on Employment and the Working Environment*, 1982, is available for \$11.40 from ILO, Washington Branch, 1750 New York Avenue, NW, Washington, DC 20006. . . . Two Canadian researchers have concluded that "there are clearly no significant technological or economic problems in achieving emission levels far below the current regulatory limit" for X-ray emissions from VDTs. In the November 1982 *Health Physics*, C.A. Hirning and J.H. Aitkin of the Ministry of Labor in Toronto report: "As long as VDTs are being made with X-ray emissions as low as the vast majority of those currently available, there is no significant radiation risk to the users and no need for any additional regulatory action. If, however, a trend toward higher emission levels were observed. . . then the [as low as reasonably achievable] principle should be invoked to require manufacturers to reduce emissions again to the present negligible levels." . . . The Electronic Industries Association is working on a new standard, *Recommended Practice for Measurement of X-Radiation from Direct-View Television Picture Tubes*, TEPAC Publication No. 164. For information, contact the EIA, 2001 I Street, NW, Washington, DC 20006, (202) 457-4900. . . . A summary of the October 1982 *International Conference on Office Work and New Technology*, sponsored by Working Women should be available in March. For information, contact the organization at 1224 Huron Road, Cleveland, OH 44115. . . . Word processors have been the source of a different kind of office problem at Ford Motor Company in Dearborn, MI: a gambling operation handling over \$5,000 a week. The January 10 *Computerworld* reports that state police nabbed three clerks who allegedly used their terminals to run a football betting pool. ●

Microwave News has published *VDTs: Health and Safety*, an 80-page booklet with an index containing all of our 1981-2 coverage of video display terminal issues. Copies are available prepaid for \$5.95 plus \$1.00 for postage and handling from: *Microwave News*, PO Box 1799, Grand Central Station, New York, NY 10163. For bulk rates (over 10 copies), please call us at (212) 794-9633. (US funds please. If your check is not drawn on a US bank, please add \$3.00 per order.)

- March 2-4: *Mobile Communications Engineering*, Washington, DC. Fee: \$685. Contact: George Washington University, Continuing Engineering Education, Washington, DC 20052, (800) 424-9773.
- March 7-8: *EMI/Testing Praxis*, suburban Philadelphia, PA. Fee: \$495. Contact: R&B Enterprises, 1050 Colwell Lane, Conshohocken, PA 19428, (215) 828-6236. Repeated • May 16-17.
- March 7-11: *Microwave Circuits: Theory and Applications*, Vienna, VA. Fee: \$850. Contact: Continuing Education Institute, 10889 Wilshire Blvd, Suite 1000, Los Angeles, CA 90024, (213) 824-9545. Repeated • April 4-8 in Palo Alto, CA.
- March 7-11: *MIL-STD 461/462 & System-Level EMI Testing and Procedures*, Washington, DC. Fee: \$965. Contact: Don White Consultants, PO Box D, Gainesville, VA 22065, (703) 347-0030.
- March 14-17: *Computational Methods in Electromagnetics*, Champaign, IL. Fee: \$580. Contact: Southeastern Center for Electrical Engineering Education, 11th & Massachusetts Avenue, St. Cloud, FL 32769, (305) 892-6146.
- March 14-18: *Spread-Spectrum Techniques and Vulnerability*, New York, NY. Fee: \$565 (IEEE), \$715 (non-IEEE). Contact: IEEE Continuing Education, Attn: Rosanne Santangelo, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0600 x 328.
- March 21-23: *MM Wave Technology*, Washington, DC. Fee: \$650. Contact: Palisades Institute for Research Services, 201 Varick St., New York, NY 10014, (212) 620-3377. Repeated • April 5-7 in San Francisco, CA.
- March 22-25: *Grounding and Shielding*, Orlando, FL. Fee: \$760. Contact: Don White Consultants, see March 7 above.
- March 24-25: *Hazardous Electromagnetic Radiation and Its Biological Effects*, Washington, DC. Fee: \$625. Contact: George Washington University, see March 2 above.
- March 28-April 1: *EMI Design and Testing*, Orlando, FL. Three one-day sessions on *Requirements & Testing per FCC Docket 20780*, *Designing to Meet FCC Docket 20780* and *Printed Circuit Board and Wiring Design for EMI Control*. And one two-day session on *Grounding, Bonding and Shielding*. Fee: \$260 for one-day sessions and \$495 for two-day sessions. Contact: R&B Enterprises, see March 7 above. Repeated: • April 11-15 in San Francisco, CA; • April 18-22 in Los Angeles, CA; • May 2-6 in Chicago, IL; and • May 9-13 in Boston, MA.
- March 29-31: *Interference Control: An Introduction to EMI/RFI/EMC*, Washington, DC. Fee: \$760. Contact: Don White Consultants, see March 7 above.
- April 5-8: *Millimeter-Wave Radar*, Washington, DC. Fee: \$780. Contact: George Washington University, see March 2 above.
- April 12-14: *Advanced Radar Technology*, Washington, DC. Fee: \$685. Contact: George Washington University, see March 2 above.
- April 18-22: *Spectrum Management*, Washington, DC. Fee: \$855. Contact: George Washington University, see March 2 above.
- April 25-29: *Communications Satellite Engineering*, Fee: \$855. Contact: George Washington University, see March 2 above.
- May 2 & 4: *EMI Test and Evaluation*, San Jose, CA. Fee: NA. Contact: Don White Consultants, see March 7 above. This course will be given at the *Test & Measurement Expo*. A number of other courses and workshops are also scheduled. For more information, contact Meg Bowen, (617) 254-1445.
- May 16-20: *Basic Radiological Health Course*, San Antonio, TX. Fee: \$450. Contact: University of Texas Health Science Center, Medical School Continuing Education Services, 7703 Floyd Curl Drive, San Antonio, TX 78284, (512) 691-6295.
- May 23-27: *Radar Systems and Technology*, Washington, DC. Fee: \$855. Contact: George Washington University, see March 2 above.
- June 6-10: *Advanced Radiological Health Course*, San Antonio, TX. Fee: \$550. Contact: University of Texas Health Science Center, see May 16 above.
- June 13-17: *Radiation Safety Officer's Course*, San Antonio, TX. Fee: \$600. Contact: University of Texas Health Science Center, see May 16 above.

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Microwave News invites contributions to *From the Field*, our monthly column featuring news and opinions from the RF/MW community. Letters from readers are also welcome.

EPA RF/MW Report Revised

The Environmental Protection Agency (EPA) has revised its draft report on the biological effects of radiofrequency and microwave (RF/MW) radiation and now states that significant effects occur at a specific absorption rate (SAR) of about 1 W/Kg. The report being prepared by EPA's Office of Research and Development (ORD), under the direction of Dr. Joe Elder, will form the basis of the first national exposure limits for the general population. EPA's limits are known as the RF/MW "guidance."

The 1 W/Kg SAR is four times lower than the threshold level cited in the 1982 American National Standards Institute (ANSI) safety guidelines, which apply to both occupational and public exposures. ANSI used a

EPA is surveying FM stations to assess the economic impact of its guidance. See p.3.

safety factor of ten to arrive at its exposure limit of 1 mW/cm² at body resonant frequencies of 30-300 MHz, based on an SAR of 0.4 W/Kg. EPA has not yet indicated what kind of a safety margin it will use for its RF/MW guidance.

At a January meeting to review the new ORD draft, David Janes, who heads the group preparing the guidance at the Office of Radiation Programs (ORP), told *Microwave News* that the revisions have not significantly changed the report's conclusions and will not affect the numbers in the draft guidance. It is rumored that the agency will propose a 100 uW/cm² limit at certain frequencies, though no details have yet been made public.

(continued on p.2)

Congressional Pressure in Radar Accident Investigation

The Secretary of the Air Force has joined the investigation into the radiation accident at Clear Air Force Station in Alaska. The Air Force's Office of Environment and Safety and its Surgeon General will review the ongoing investigation and report back to the Secretary.

The growing interest in the September 14 accident in which six workers were over-exposed to radar radiation follows a call for a new investigation by Alaska Congressman Don Young. In a January 14 letter to Air Force Secretary Verne Orr, Young asked for a new survey of the workers' radiation exposure by a "neutral party at the earliest possible date" and a "full scale investigation of the internal safety practices and procedures at Clear Air Force Station." Young, a Republican who is Alaska's only congressman, asked Orr to look into the accident personally.

The six workers, all civilian technicians, have charged that there was a gross misunderstanding of radar radiation at Clear and that there were extensive delays in providing them with expert medical attention. In addition, they have questioned the reliability and accuracy of the Air Force's September 22 accident simulation (see *MWN*, November 1983).

(continued on p.2)

Young's Letter

In his letter to Orr, Congressman Young wrote: "I am convinced that the Air Force and the civilian contractor have not cooperated in good faith with the affected employees." He added that some of the test equipment used in the accident simulation run by the Air Force and FELEC Services was "defective, improperly calibrated and improperly employed by operating personnel."

Young pressed Orr for a new simulation of the accident "in order to reestablish employee trust in their government and its agencies."

Captain Johnny Whitaker, an Air Force spokesman, told *Microwave News* that no new simulation of the accident was planned. He said that there is no deadline for the continuing investigation. "It will take whatever time is necessary," he said.

Alaska Senators Ted Stevens and Frank Murkowski, both Republicans, have endorsed Young's efforts, but, for the moment, are letting him take the lead in applying pressure on the Air Force.

In an interview, an aide to Senator Stevens said that the senator was pleased with the way Congressman Young was pursuing his inquiry. Earlier, Stevens had announced that he was satisfied with the Air Force's investigation.

Senator Murkowski has expressed concern over the medical attention the workers had received. In a December 5 letter to General James Hartinger, the commander-in-chief of the North American Air Defense (NORAD) Space Command in Colorado, Murkowski wrote: "I am particularly concerned about those who feel that they have not received adequate attention almost three months after the accident." He went on to ask "why there are still so many unanswered questions from the workers at this late date."

Before the Air Force Secretary became involved, the investigation into the accident was being handled by the Air Force Inspection and Safety Center at Norton Air Force Base, CA. The center is under the aegis of the Air Force's Inspector General.

Clear Air Force Station is operated for the Air Force by FELEC Services Inc., a subsidiary of ITT.

Mishap Report

At the end of December, the safety center released a "mishap report" on the Clear incident. The report states that it "appears" that the workers were exposed to radiation for eight minutes. This has been contested by the workers, who believe the exposure was longer —perhaps as long as 17 minutes.

The report also details the approximate levels of exposure experienced by the six men while they were performing routine maintenance on one of the Ballistic Missile Early Warning System (BMEWS) radars. According to the Air Force report, the workers' exposures ranged from a maximum of 105 mW/cm² for Karl Kepler to 12-19 mW/cm² for Richard Eldridge and John Jessup. Two of the men, Ronald Foster and Edward Forsling, were exposed to 45-55 mW/cm² and one, William Emmons, to 90 mW/cm². Two

electricians who were at the base of the radar when the power was turned on were exposed to less than 25 uW/cm².

One of the workers expressed doubts about the relative intensities of the exposures. In an interview, Eldridge disputed the Air Force's contention that he and Jessup received a fraction of Emmons's dose. "Emmons could not have been standing more than three feet away from us," he said, "because he was supervising our welding." Emmons confirmed to *Microwave News* that he was very close to Eldridge at the time of the accident; he estimated that they were about 18 inches apart. Emmons added that he might have been a little closer to the trap door leading to the screen of the radar antenna.

Other recent developments concerning the radar accident include:

- The Alaska Department of Labor's Division of Labor Standards and Safety issued two citations against FELEC Services for over-exposing six workers to radiation. The citations carry a penalty of \$840. On January 6, Ralph Drew, FELEC's manager at Clear, notified the state that the company would contest the citations.
- John Jessup and Ronald Foster went to Brooks Air Force Base for a medical examination in January. The other four men were examined at Brooks in October. The two FELEC employees originally declined to go to Brooks because they lacked confidence in Air Force objectivity.
- On February 1, Thomas Lucas, a field attorney with the National Labor Relations Board (NLRB) is scheduled to meet with Eldridge to hear his grievance regarding his dismissal from FELEC on November 10 (see *MWN*, December 1983).
- Repeated requests by *Microwave News* for the accident report prepared by FELEC Services went unanswered. ●

EPA Guidance (continued from p.1)

Report Revisions

At a January 24-25 meeting in Research Triangle Park, NC, a special EPA Scientific Advisory Board (SAB) panel found that the revised ORD report provides a satisfactory review of the literature and a sound basis for setting exposure guidelines. Its approval follows extensive revisions in ORD's treatment of thermal physiology, the backbone of the first draft.

ORD rewrote its summary and conclusions to accommodate criticisms made at the panel's first meeting last September (see *MWN*, October 1983).

Instead of focusing on thermoregulatory response thresholds, the draft now cites a range of considerations for pinpointing the onset of significant bioeffects at 1 W/Kg, including effects on endocrine gland function, blood chemistry, hematology and immunology. The authors also state that behavioral changes can occur in certain environments at lower threshold SARs than those cited by ANSI. In addition, they mention one experiment which indicates RF/MW radiation may be a cancer promoter and another which shows radiation may affect brain cells. Finally, the special

susceptibility of the central nervous system to radiation and the need for more research on calcium efflux are noted.

In the initial draft, ORD calculated that human thermoregulatory response was triggered by SARs of about 0.27 to 0.81 W/Kg, or 1.2 to 2.6 mW/cm² at body resonant frequencies.

At the September panel meeting, Dr. Eleanor Adair and other panelists warned that EPA's ORD should not have estimated human thermal response thresholds from animal data. Accepting this criticism, ORD concluded that these thresholds cannot be adequately predicted given the lack of human data.

Although thermoregulation was the most thoroughly discussed and revised area of the report, panelist Dr. Stephen Cleary advised at the close of the January meeting that the time devoted to this topic does not reflect its importance regarding regulation of public exposures.

ORD agreed to a number of additional minor changes at the January meeting and has a little work left to do. For example, EPA's Dr. Carl Blackman will write a brief review of post-1980 literature on calcium efflux.

On the whole, the panel decided that the addition of papers published after 1980 would not affect the basic conclusions of the report.

Panel Recommendations

In addition to tentatively approving the report, the panel decided to outline a number of research areas that it believes EPA should pursue after the guidance is set. In a draft of the cover letter they will send to SAB Chairman Dr. Norton Nelson, the panel members singled out the effects of frequency modulation, chronic versus acute exposures, partial body versus whole body exposures, high power pulsed sources versus ones that are adequately characterized by average power, and several other topics.

Panel chairman Dr. Charles Susskind suggested that a final draft of the report be sent to SAB Director Dr. Terry Yosie by mid-February so that the board's executive committee can review it before its April meeting. The executive committee must approve the final report.

Speedy approval could be important for ORP, which is pushing to complete a draft guidance and supporting material by June 1. The proposal will not be released before the bioeffects report is issued and must itself receive final EPA approval and pass a review by the Office of Management and Budget.

Both the revised report, *Biological Effects of Radiofrequency Radiation*, No. EPA-600/8-83-026A, and the cover

letter must still be reviewed by the following panel members who were unable to attend the meeting: Drs. Barbara Chang, Carl Durney, Steven Horvath, Abraham Lilienfeld and Charlotte Silverman.

Panel members attending the meeting were Drs. Eleanor Adair, Stephen Cleary, Arthur Guy, Sol Michaelson, Mary Ellen O'Connor and Chairman Charles Susskind. Yosie and SAB Executive Secretary Dr. Douglas Seba were also present.

EPA's guidance will only apply to federal facilities, but since it is the first and only federal exposure rule for the general public, it will become the de facto US standard. The draft has already circulated among federal agencies for review. ■

EPA Surveys FM Stations

EPA is surveying over 1,000 FM radio stations to better assess the economic impact of its planned public exposure guidance for RF/MW radiation. Officials at the agency's Office of Radiation Programs (ORP) in Las Vegas, NV, anticipate that the survey will show that public exposures to FM radiation are lower than EPA models currently predict.

Though the agency is evaluating the potential effect of the guidance on all types of broadcasters, the survey is limited to FM (88-108 MHz) because, as a class, these stations are estimated to produce the highest public exposures falling within the 500 kHz-100 GHz range of the guidance.

According to the cover letter sent out with the questionnaires last month, participation is voluntary but a "prompt and accurate response will help to insure that a realistic estimate" of the economic effect of the guidance is achieved.

In an interview with *Microwave News*, EPA's Ric Tell explained that land use data from the questionnaires will indicate whether or not areas near the stations with high RF/MW levels are accessible to the public. An inaccessible area will not be considered a public hazard. Of the more than 4,000 FM stations in the US, the agency sent questionnaires to those estimated to produce the highest exposure levels.

The agency has asked broadcasters how close the public can get to the targeted FM antennas and whether there are other broadcast sources either sharing a station's tower or in the immediate area, as in an antenna farm.

Although the guidance will only be enforceable for government facilities, private sector broadcasters are likely to be required to meet EPA limits by the Federal Communications Commission (FCC). Commission policy is still not set, but it has proposed rules that would require compliance from new or modified facilities. The FCC has yet to say how it will deal with existing broadcasters.

EPA will summarize the survey responses and then forward the data to a team at Lawrence Livermore National Laboratory in California, which is preparing the economic assessment for EPA (see *MWN*, December 1981). The agency hopes to have the proposed guidance and its supporting material ready for publication in early June.

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Navy Loses ELF Suit

On January 31, Federal Judge Barbara Crabb ruled in favor of the State of Wisconsin and Marquette County, Michigan, and stopped all work on Project ELF, the Navy's submarine communications system. The Navy must now prepare a supplemental environmental impact statement (EIS) before construction can resume.

Wisconsin Attorney General Bronson La Follette had charged that the Navy's 1977 EIS failed to take into account recent studies on the health effects of extremely low frequency (ELF) radiation as well as changes in the proposed antenna design (see *MWN*, July/August 1983). The suit was filed on July 20, 1983 in US District Court for Western Wisconsin.

The judge not only barred further construction of the ELF antenna in northern Wisconsin and Michigan's Upper Peninsula, but stopped the placement of receivers on submarines. The Navy has not yet announced whether it will appeal the decision.

The verdict came as we go to press with this issue. We will publish a more detailed story with excerpts from the judge's 69-page decision next month.

EPA and NIEHS To Replicate Delgado Study

Researchers at the Environmental Protection Agency (EPA) and the National Institute for Environmental Health Sciences (NIEHS) will attempt to replicate Dr. Jose Delgado's experiment which found that very weak, pulsed magnetic fields affect growth and development. The work reported by Delgado's lab in Spain has received widespread attention because it showed that magnetic fields less intense than the earth's produced severe effects.

Dr. Ezra Berman, an expert in teratology at EPA's Health Research Laboratory in Research Triangle Park, NC, told *Microwave News* that the experiment must be repeated "simply because the results are so unusual." The replicate study could get underway by the end of this summer.

Delgado's group at the Centro Ramon y Cajal Hospital in Madrid found significant malformations in chick embryos exposed to pulsed magnetic fields of 0.12, 1.2 and 12 microTesla (uT) for 48 hours at frequencies of 10, 100 and 1000 Hz. Delgado reported that the most marked effect occurred at 100 Hz and 1.2 uT (see *MWN*, March 1983 and *Journal of Anatomy*, 134, 533, 1982).

In a recently published follow-up experiment, Delgado showed that pulse shape was the key variable in achieving an effect (see *MWN*, November 1983 and *Journal of Anatomy*, 137, 513, 1983).

Berman said the US effort will attempt to repeat the experiment as closely as possible but with more eggs. He noted that Delgado worked with a total of 68 eggs, while the US experiment will probably use 40 to 50 eggs per exposure group.

Current plans call for running the experiment at NIEHS

facilities at North Carolina State University in Raleigh. The institute's Dr. Don McRee will perform the exposures and Berman will examine the eggs. Ric Tell, from EPA's Office of Radiation Programs in Las Vegas, NV, will handle the critical job of designing the exposure conditions. The exposures will take about three months to complete.

Both Berman and Tell stress that the main difficulty in doing the study is that no one knows exactly how Delgado's group set up its experiment. The researchers hope they will get more detailed information.

Tell has tried to reproduce the Delgado experiment himself with no success and told *Microwave News* he is very pleased that people with greater expertise will try it.

The importance of Delgado's study is magnified by the general lack of research on extremely low frequency (ELF) fields. EPA is just beginning to turn its attention to this area. According to an EPA spokeswoman, the agency hopes to develop an ELF research program in the coming years, now that its work on a general population guidance for the 500 kHz-100 GHz range is nearly complete. Congress has also taken an interest in ELF and last year directed the agency to investigate the effects of 60 Hz power line radiation (see *MWN*, June 1983).

Shortwave Radiation Linked to Heart Disease

Chronic exposures to 27 MHz radiation have been associated with heart disease in a new epidemiological study of male physical therapists. This report is believed to be the first from the US to make this link, although a number of Soviet and Eastern European studies have associated radiofrequency and microwave radiation with heart ailments.

Health data from 3,004 therapists who used ultrasound, infrared, microwave and shortwave diathermy equipment were analyzed. Only the link between shortwave (27 MHz) diathermy and heart disease was statistically significant. The study by Dr. Stanford Hamburger, James Logue and Phyllis Silverman of the Food and Drug Administration's (FDA) National Center for Devices and Radiological Health is reported in the *Journal of Chronic Diseases*, 36, 791, 1983.

The paper does not address the pregnancy outcomes of the therapists' wives. In a telephone interview, Silverman said that the pregnancy data from the survey are being prepared for a second paper.

The data used in this study were collected by Dr. Jeanne Stellman under a two-year FDA contract while she was at the American Health Foundation. In 1980, Stellman reported preliminary results which indicated a number of adverse health effects among the therapists including hypertension, hearing disorders, bilateral cataracts and blood and endocrine disorders—but not heart disease. Stellman is now at Columbia University in New York City.

Stellman told *Microwave News* that recent analyses confirmed her earlier findings, but she could not explain the

differences between her results and those of FDA. Stellman is in the process of writing up her results in a number of papers and expects to publish them later this year. She said that her study had been delayed by a shortage of funds: "It took the Office of Management and Budget (OMB) a year to approve my questionnaire, and after that I ran out of money." Stellman said that she has been finishing her research in her spare time.

Silverman suggested that the two sets of results might be due to differences in the statistical techniques used by FDA and Stellman.

Another possible explanation lies in the data sets analyzed by FDA and Stellman: each reports a different response rate. The FDA group claims a response rate of 58 percent, while Stellman has questionnaires from 68 percent of the original sample. Silverman said that while she believes the FDA group did not have about 400 of the original Stellman questionnaires, they did have a computer tape with all the data. (Only those cases that were accompanied by questionnaires were included in the FDA analysis.) A check of the missing responses indicated no obvious pattern of adverse health effects, according to Silverman.

New Jersey Weighs ANSI's RF/MW Exposure Standard

New Jersey is moving forward with plans to adopt a radiofrequency and microwave (RF/MW) radiation exposure standard based on the new American National Standards Institute (ANSI) guidelines. The proposed rules, which at their strictest level would limit public exposures to 1 mW/cm² in the 30-300 MHz frequency band, were discussed at two public hearings last month.

In a statement issued before the January 24 and 31 hearings, the New Jersey Commission on Radiation Protection maintains that the ANSI C95.1-1982 standard "represents a consensus of current thinking by scientists active in this discipline," and that it is "extremely conservative, thereby assuring a wide margin of safety." The commission is composed of representatives from state government and the private sector and has the authority to set state radiation standards.

According to the commission, the action is a response "to the public's apprehension concerning misuse of radiofrequency radiation in the absence of national safety level guidelines." Commission member Eugene Fisher of the state's Bureau of Radiation Protection told *Microwave News* that the group "is not confident that a federal standard will be in place in the near future."

If no major revisions are required, the eleven-member New Jersey committee could approve the standard in February.

Massachusetts, the first state to set RF/MW population limits, took a different standard-setting approach last year and adopted a rule five times more strict than ANSI (see *MW*, November 1983).

One of the commission's main objectives is economic. It

believes that a standard will help in eliminating "unnecessary time delays in the installation of new facilities with a cost saving to industry which will ultimately result in a reduction in the cost of such service to the public." Several communications companies planning to build new facilities or expand existing ones in New Jersey have met stiff community resistance over the RF/MW safety issue (see *MW*, November 1982 and November 1983). A number of residents opposing new broadcast sources have announced that they believe the proposed standard is too high.

The New Jersey rules would apply only to public exposures in the 300 kHz-100 GHz frequency range. In addition to broadcast sources, the frequency-dependent standard would include an emission standard for microwave ovens. Emissions from units built after 1971 would be limited to 5 mW/cm² measured at a distance of 5 cm and to 10 mW/cm² for those built before 1971. The draft's wording regarding ovens is unclear and Fisher reports that an appliance manufacturers' group is proposing new language for this section of the rule.

In addition to the January hearings, the public was invited to comment on the action in writing before February 3. Submissions are being collected by Fisher at the Department of Environmental Protection, Bureau of Radiation Protection, 380 Scotch Road, Trenton, NJ 08628.

The committee members are Max Weiss, Chairman, AT&T Bell Telephone Laboratories; Benjamin Sonnenblick, Rutgers University; Henry Powsner, Princeton Medical Center; Seymour Baron, Burns & Roe; Fred Sterzer, RCA Laboratories; and representatives from the New Jersey Departments of Health, Labor and Environmental Protection.

Ontario Hydro Plans VDT-Pregnancy Research

Researchers at Ontario Hydro have announced they will investigate possible links between pregnancy problems among VDT operators and electromagnetic (EM) radiation from terminals. In a progress report on their continuing work on VDTs, the scientists recommend both a laboratory and an epidemiological study. The latter, which would be more costly and take longer, may not be undertaken.

The report, "Hazards Assessment of Video Display Units [HAVDU] — Report on Phase I Activities," concludes that there is no danger to operators from ionizing radiation, including X-rays, but stops short of dismissing EM radiation risks. The Ontario Hydro investigators measured EM fields and charges from flyback transformers, low-voltage circuitry and display screens.

The Ontario Hydro report recommends "an experiment involving the exposure of small animals to [EM] fields be performed to gain evidence on potential adverse pregnancy outcomes due to exposure to the types and magnitudes of the [EM] fields generated by a VDT." In an interview after the report was released, Ontario Hydro's Robert Facey told *Microwave News* that this study will use VLF fields between 15 and 17 kHz. Ontario Hydro will spend \$50,000

HIGHLIGHTS

and solicit \$40,000 from outside sources for this research. The company will fund the entire project if external help is not available, Facey added.

The proposed epidemiological study would cost \$500,000 and take four years to complete. Its purpose would be to increase the "limited" data available on pregnancy outcomes among VDT operators. Ontario Hydro's Phase I report calls for a limit of \$100,000 on its total contributions and recommends that the company solicit additional funds starting in April 1984 unless a similar study is underway elsewhere.

The scientists also propose to measure magnetic fields near VDTs in Phase II using techniques similar to those used to characterize electric fields in Phase I.

EM fields from the flyback were in the very low frequency (VLF) range (15.8-18.5 kHz) with average (root mean square) field strengths between 3 and 30 V/m at 30 cm from the front of the terminal. These emissions are pulsed and Ontario Hydro researchers measured peak values as low as 4 V/m and as high as 170 V/m.

Electrostatic fields of up to 7,000 V/m were measured. Fields from the electronic circuitry were less than 1 V/m.

The report cautions that all the EM readings are approximately ten times the real exposure levels as a result of the measurement method used. Dr. Stuart Harvey, who supervised the EM testing, explained that the meter used in the laboratory gives a reading that exceeds actual levels by this amount.

The significance of these radiation readings is unclear. "No experimental data were uncovered which directly demonstrate evidence of biological harm due to fields generated by VDTs; however, conversely, to our knowledge there is no published work which shows the absence of such effects," the study explains.

With regard to ionizing radiation, measurements failed to find emissions above ambient levels in 80 percent of the units tested. The remainder of the units produced readings two to four times that of background apparently due to the presence of potassium-40, a radioactive isotope, in the glass screens. These levels are of "no medical significance" according to the researchers.

Ergonomic guidelines available to VDT users and supervisors are inadequate, according to the report. In most cases guidelines are not compatible or consistent. The study recommends design standards for desks, chairs, keyboards, screen characteristics and lighting.

Project HAVDU was started in 1982 in response to a labor-management agreement, and to concerns among company scientists that VDT work is a "cause of anxiety among women employees." The Phase I report was presented to Ontario Hydro's Board of Directors in mid-November and became publicly available in mid-January. The projected completion date for Phase II is April 1985.

Copies of the full report can be ordered from Mr. Robert Facey, Safety Services, Ontario Hydro, 757 McKay Road, Pickering, Ontario L1W 3C8, Canada. The cost per copy is \$13 US, \$16 Canadian. A 35-page summary is available from the same address for \$4 US, \$5 Canadian.

SHORT COURSES

March 5-6: Grounding, Bonding & Shielding, San Francisco, CA. Fee: \$495. Contact: R&B Associates, 20 Clipper Rd., W. Conshohocken, PA 19428, (215) 825-1960. Repeated **March 8-9**: Los Angeles, CA.

March 5-7: Planning for and Operating an NMR Imaging Facility, Washington, DC. Fee: \$750. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

March 12-15: Modern Microwave Measurements, Washington, DC. Fee: \$895. Contact: Continuing Education Institute (CEI), 5410 Leaf Treader Way, Columbia, MD 21044, (301) 596-0111 or (213) 824-9545.

March 12-15: Computational Methods in Electromagnetics, Galveston Island, TX. Fee: \$650. Contact: Ann Beekman, Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 11th & Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

March 12-16: Radiowave Propagation for Communications Systems Design, Orlando, FL. Fee: \$875. Contact: GWU, see March 5 above.

March 15-16: Lightning Protection, Orlando, FL. Fee: \$625. Contact: GWU, see March 5 above. Repeated **June 4-5**: Washington, DC.

March 19: Applying Military Electromagnetic Compatibility Specifications, St. Louis, MO. Fee: \$295. Contact: Jean Tucker, ECOS Environmental Solutions, 205 W. Harrison St., Oak Park, IL 60304, (312) 383-2505. Repeated **April 16**: Chicago, IL.

March 19-23: Flat-Panel and CRT Technologies, Los Angeles, CA. Fee: \$895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

March 20-22: Grounding & Shielding, Sunnyvale, CA. Fee: \$815. Optional fourth day for \$235. Contact: Don White Consultants Inc. (DWCI), Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

March 22-24: NMR: A Primer for Radiologists, Hilton Head Island, SC. Fee: \$375. Contact: K.V. Pyles, Foundation for Education in Magnetic Resonance, 111 Glade Park East, Kittanning, PA 16201, (412) 545-7085.

April 3: EMC: The FCC Means Business, Boston, MA. Fee: \$595. Contact: Carol Clark, McGraw-Hill Seminar Center, 331 Madison Ave., Suite 603, New York, NY 10017, (212) 687-0243.

April 9-10: Grounding, Bonding & Shielding, Washington, DC. Fee: \$625. Contact: GWU, see March 5 above.

April 30-May 4: EMC Design & Measurement for Control of EMI, San Diego, CA. Fee: \$995. Optional fifth day for \$235. Contact: DWCI, see March 20 above.

April 30-May 4: NBS Noise Measurement Seminar, Boulder, CO. Fee: \$775. Contact: Sunchana Perera, Div. 723.05, National Bureau of Standards, Boulder, CO 80303, (303) 497-3546.

April 30-May 4: High Frequency Spectrum: New Concepts and Technologies, Washington, DC. Fee: \$875. Contact: GWU, see March 5 above.

May 7-11: Microwave High Power Tubes and Transmitters, Washington, DC. Fee: \$875. Contact: GWU, see March 5 above.

May 7-11: Microwave Circuits Design: Linear Circuits, Palo Alto, CA. Fee: \$895. Contact: CEI, see March 12 above. Repeated **June 4-8**: Boston, MA.

May 7-11: Electromagnetic Interference and Control, Washington, DC. Fee: \$875. Contact: GWU, see March 5 above.

May 8-11: Modern Antennas, Washington, DC. Fee: \$675. Contact: Linda Billard, Technology Service Corp. (TSC) 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

May 15-17: An Introduction to EMI/RFI/EMC, Los Angeles, CA. Fee: \$815. Contact: DWCI, see March 20 above.

May 21-23: Hazardous RF Electromagnetic Radiation, Washington, DC. Fee: \$695. Contact: GWU, see March 5 above.

FROM THE FIELD

Responses to Dr. Robert Becker's Letter on Use of Electromagnetic Stimulation for Bone Growth

In our November issue, we published a letter sent to the FDA by Dr. Robert O. Becker on the risks associated with the growing use of medical devices that apply direct currents and pulsed electromagnetic fields to stimulate bone growth. Published below are the FDA's response to Becker and a letter to *Microwave News* from Dr. C. Andrew L. Bassett.

Dear Dr. Becker:

The Food and Drug Administration (FDA) has completed its initial review of your concerns regarding the safety of electromagnetic stimulation of biological tissues as a treatment therapy. The agency believes it is essential to continually evaluate the safety and effectiveness of electromagnetic stimulation as the technology evolves and new data accumulates. We would like, therefore, to thank you for your comments and encourage you to submit any additional comments or relevant data, as you feel appropriate.

We are familiar with most of the information you provided. The bulk of the data you refer to has only recently become available (articles dated 1982 and 1983). As you observed there is little, if any, corroborating evidence for much of the recent research you cited.

As you know, the agency has approved three premarket approval applications for devices involving electromagnetic stimulation for healing of bony defects. These approvals were based on all the information available at the time of approval. These approvals required that four-year follow-up examinations be performed by the sponsor on all patients in the approved trials. These examinations were explicitly requested to substantiate "long-term" safety and effectiveness of the approved devices. This four-year time period has not been reached by all patients; thus, the data which will address many concerns is incomplete.

Furthermore, we are also aware of the need to proceed judiciously in the clinical application of a new therapeutic modality such as electromagnetic stimulation. This agency has determined that all such devices are significant risk devices. As such, any sponsor wishing to clinically investigate these devices must receive FDA approval for an investigational device exemption (IDE) prior to initiating the trial. Therefore, we will continue to evaluate the most up-to-date information available regarding the safety and effectiveness of these devices.

Thank you again for your comments. If you have any questions regarding this matter contact me at (301) 427-7156.

Carl A. Larson, Ph.D.

Director, Division of Surgical and Rehabilitation Devices
Office of Medical Devices
National Center for Devices and Radiological Health
Food and Drug Administration, Silver Spring, MD 20910

To the Editor:

Dr. Robert O. Becker has called for a moratorium on clinical application of "bone growth stimulators" because he postulates a possible link between such devices and "malignant transformation." Anyone who has followed his writing and statements will recognize that this position has not changed for the past ten years. In fact, at the 1973 New York Academy of Sciences Conference on "Electrically-Mediated Growth Mechanisms on Living Systems," Dr. Becker sounded his first alarm, "When this field began to open up and clinical use was being postulated, and some patients were

actually undergoing treatment, I raised the question of possible induction of malignant cellular changes." [1]

During the intervening ten years, more than 40,000 patients have been treated with various electrical devices to modify bone formation by one mechanism or another, without a single report of malignancy as the result of such use. Extensive laboratory investigations of these devices have taken place *in vitro* and *in vivo* all over the world, again, with no evidence that they induce cancer. This point is conceded by Becker, himself, in his FDA letter.

In the United States, where the electrical devices have been regulated by the FDA since 1979, there is a legal requirement for device manufacturers to report all untoward reaction and, to my knowledge, the cancer issue is a "non-issue" at the present time.

I will not attempt to point out or correct each of the inaccuracies which are contained in the letter. Interested readers are referred to the appended bibliography for details, which can place the issues in a more comprehensive light. There are two main inaccuracies, however, which deserve attention by your readers. The first concerns safety testing and is embodied in his sentence, "When the FDA approved these devices there were no studies on the effects of...magnetic fields on embryonic growth and development or malignant growth." The facts are: extensive data from teratologic and toxicologic studies in animals were made available to the FDA for the two pulsed electromagnetic field (PEMF) modes which were approved. These included documentation of a lack of chronic-exposure PEMF effects on multiple soft tissues and organs such as the heart, kidneys, liver, spleen, adrenals, lung and brain, among others. Furthermore, mice mated, delivered and reared through the F5 generation (constantly exposed individually to two types of PEMFs) showed no birth, development or functional abnormalities. In addition, both pulse modes were tested on Meth A sarcomas in Balb/C mice and were demonstrated to have no effect on tumor weight, mitotic indices, tumor microanatomy or behavior. Similarly, both pulses had no effect on normal animal longevity or the spontaneous tumor incidence in Swiss Webster mice. All of these data were submitted to the FDA as part of the pre-market approval and continuing monitoring processes. Under the Freedom of Information Act, I believe, these findings have been available to one and all, if they were concerned. As a matter of record, the safety of these two pulse modes has been investigated, independently, both in academic and commercial settings, and the original assessments confirmed.

The second critical issue which deserves comment is what I call the "lumping syndrome." No one would consider saying to a physician or a scientist, "I treated my patients with drugs" without specifying the agents, their dose, their routes or schedules of administration. Yet, electrical modalities of a wide variety, are now being "lumped" into the "bone growth stimulator" heading with little or no evidence that each fits [2]. Similarly, because one type of time-varying electromagnetic field produces an untoward effect under *highly selected* circumstances, *all* such fields frequently are impugned. Conversely, because PEMFs are effective in a given clinical setting, entrepreneurs who try a "coat-tail" approach, either are unaware, themselves, of the very selective nature of pulse specificity or are counting on an uninformed user, when "equivalency" is claimed.

With every passing month it is more and more clear that both different and similar pulses can cause different biological effects in different tissues at different times in the cell cycle [3-14]. In fact, the postulated importance of frequency, amplitude and cell cycle "windows" to achieve selected alterations in cell function is now supported by a considerable body of scientific data. Falling prey to the "lumping syndrome" signals a lack of familiarity with those data.

(continued on p.8)

FROM THE FIELD

Finally, a moratorium on FDA-approved clinical applications of selected PEMFs, clearly, is not justified by the facts. Deleterious effects have not been reported in the more than 20,000 patients treated with these two pulse modes. The longest follow-up, now, is nine years and the method has been used successfully on a number of occasions to heal ununited fractures in bone with quiescent (treated) primary tumors. In none of these individuals has there been any evidence of "re-lighting" the tumor for intervals exceeding five years post-treatment. Let us not risk "throwing the baby out with the bath water."

C. Andrew L. Bassett, MD

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- [1] A.R. Liboff and R.A. Rinaldi, *Annals of the New York Academy of Sciences*, 238, 587, 1974.
- [2] C.A.L. Bassett, *Calcified Tissue International*, 34, 1, 1982.
- [3] C.A.L. Bassett et al., in *Electrical Properties of Bone and Cartilage: Experimental Effects and Clinical Applications*, C.T. Brighton et al. eds. New York: Grune and Stratton, 1979, pp. 427-441.

UPDATES

BIOLOGICAL EFFECTS

Collection of Papers...The IEEE Press has assembled into one large volume a collection of more than 60 papers on the interaction of RF/MW radiation with living systems. The papers, reprinted as they were originally published, are divided into seven groups, each with an introduction and a list of references. *Biological Effects of Electromagnetic Radiation* was edited by Dr. John Osepchuk of Raytheon with the help of Drs. James Frazer, Om Gandhi, Arthur Guy, Don Justesen, Sol Michaelson and John Mitchell. The 593-page collection is available for \$47.95 to IEEE members and \$79.95 to non-members from IEEE Press, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060.

COMMUNICATIONS

WARC...Delegates from 112 nations have gone to Geneva, Switzerland, for the World Administrative Radio Conference's (WARC) five-week meeting on high frequency (shortwave) communications. For a review of the issues to be addressed, see the January 9 *Broadcasting*....The FCC has amended its rules to comply with the "Final Acts" of the 1979 WARC. The commission states that this action "provides domestic radio spectrum users with protection from harmful interference as provided by international regulations." The FCC's lengthy discussion of the rules and the public comments they generated, and a modified table of frequency allocations, appear in the January 19 *Federal Register*.

COMPATIBILITY & INTERFERENCE

Aircraft RFI...At the first meeting of the Radio Technical Commission for Aeronautics (RTCA) Special Committee 156 on "Potential Interference to Aircraft Electronics Equipment from Devices Carried Aboard" on December

1-2, a testing program was initiated to determine if there is an RFI problem caused by the use of computers aboard planes (see *MWN*, October 1983). Representatives from the airlines, the air frame manufacturers and the FAA will gather path loss data by simulating the decay of emissions through windows and the aircraft itself. At the same time, the computer companies will check the emissions from various devices. It was noted that radiation levels allowed under RTCA/DO-160A are more stringent than those allowed under FCC Part 15 and that the stricter limits may be needed to prevent harmful RFI. The next meeting of SC-156 is scheduled for February 28-29. In the meantime, the committee members agreed that interim steps to stop passengers from using computers during flight, including during take offs and landings, were not necessary.

Sonic Cable TV Fine Upheld...The FCC has refused to rescind its \$6,000 fine against Sonic Cable TV (serving Grover City, Arroyo Grande and Pismo Beach, CA) for leaking signals which interfered with amateur radio communications (see *MWN*, November 1982). The commission did not find Sonic's procedural and substantive arguments persuasive: "Sonic has chosen to raise a plethora of unmeritorious arguments to mask its rule violations." The FCC responded to Sonic's charge that it was the victim of "selective prosecution" by noting that although the "commission's limited resources may result in violators going unpunished, this does not mean we cannot impose sanctions against those we find violating our rules."

Immunity Task Group...ANSI C63's ad hoc committee on enhancing the immunity of home electronic equipment to RFI is moving ahead. Meetings were held in October and December and another is planned for February 10 at the FCC Labs in Columbia, MD. At that time, the committee plans to put the final touches on a questionnaire, which will

be published in the American Radio Relay League's (ARRL) magazine, *QST*. FCC's Dan Yates, a member of the committee, pointed out that the questionnaire is virtually identical to the one used by the commission's Field Operations Bureau for reporting RFI complaints. Meanwhile, the Electronic Industries Association's Consumer Electronics Group has completed its measurements on the immunity of TVs and VCRs; the results are under review. As work on TVs and VCRs winds up, the committee will soon begin studying cordless phones and home security systems. Don Heirman of AT&T Information Systems Labs, the committee chairman, said that the new and the old efforts will continue simultaneously.

NBS Noise Seminar...NBS is holding a week-long seminar on precision noise measurements, stressing applications in antenna and communication systems, April 30 to May 4 in Boulder, CO. Taught by members of the Noise Metrology Group in NBS' Electromagnetic Fields Division, the seminar costs \$775. For more information contact NBS' Sunchana Perera, (303) 497-3546.

Resources...The Soviet "Woodpecker" transmitter is causing interference problems again, according to an item in the December *QST*. The magazine quotes a Norwegian official as saying that the Woodpecker, located in Kiev, is interfering with almost a tenth of the radio traffic over the shortwave band in Norway....An article in the November 3 *New Scientist* cites the dangers of trying to use signals from high power CB radios to confuse the electronics of gas station pumps. There is no way of knowing whether the radiation will make the gas meter run faster or slower. And there is the risk that it can trigger an explosion. In fact, author Barry Fox notes, this effect has been exploited in the Northern Ireland conflict....A.J. Mauriello of Radiation Sciences, Inc., in Lansdale, PA, and J.M. Clarke of the Air Force's Electronics Systems Division at Hanscom AFB have published "Measurement and Analysis of Radiated Electromagnetic Emissions from Rail-Transit Vehicles" in the November *IEEE Transactions on Electromagnetic Compatibility*....The Office of Technology Assessment (OTA) cites EMI as one barrier to magnetic levitation systems for high-speed intercity passenger service. See OTA's *US Passenger Rail Technologies*, available for \$4.75 from the Government Printing Office, Washington, DC 20402. Order No. 052-003-00938-2....EMI problems in the automobile industry were featured in a December 20 *New York Times* article by John Holusha....Papers are being solicited for the 6th Symposium and Technical Exhibition on *Electromagnetic Compatibility* to be held at the Swiss Federal Institute of Technology in Zurich, March 5-7, 1985. The theme of the conference is "protection of the electromagnetic environment." Professor Ralph Showers of the University of Pennsylvania is again serving as the chairman of the Technical Program Committee. Abstracts are due before March 15, 1984. For more information, contact: Dr. T. Dvorak, ETH Zentrum-IKT, 8092 Zurich, Switzerland, 256-2790....NASA has issued a RfP (No.5-79683/235) to "determine critical areas of EMI/EMC interaction between

the spacecraft and electronics payload and identify areas where potential EMI problems exist." The space agency anticipates awarding one contract in March.

GOVERNMENT

IEEE Spectrum...Watch for the March issue of *IEEE Spectrum*, which will feature a major article on the current regulatory climate in Washington, DC, as it affects the use of non-ionizing electromagnetic radiation.

INTERNATIONAL

Hungarian Standards...In 1982, Hungary proposed new safety standards for workers and the general population. The proposal is comparable to other Eastern European RF/MW health standards and is more stringent than the new ANSI guidelines and other Western standards. For 300 MHz-300 GHz, the draft exposure limit for the general population is 10 $\mu\text{W}/\text{cm}^2$, while for workers it is 1 mW/cm^2 . For 30 kHz-30 MHz, the limits are 20 V/m and 50 V/m for public and occupational exposures respectively; for 30-300 MHz, they are 10 V/m and 20 V/m respectively. Higher exposure levels are permitted for short periods of time, but the absolute maximum levels for all individuals are (1) 30 kHz-30 MHz: 1000 V/m; (2) 30-300 MHz: 500 V/m; and (3) 300 MHz-300 GHz: 10 mW/cm^2 . The proposed limits do not differentiate between CW and pulsed radiation. The Hungarian paper was translated by Information Ventures, Inc., and is excerpted in its most recent edition of *Biological Effects of Non-Ionizing Electromagnetic Radiation* (Vol. VIII, No. 1, October 1983). A limited number of copies are available from the Office of Naval Research, Code 441, 800 North Quincy St., Arlington, VA 22217 (include a self-addressed mailing label).

MEDICAL APPLICATIONS

BSD's Hyperthermia Units Approved...On November 28, the FDA approved BSD Medical Corporation's BSD-1000 hyperthermia system as "safe and effective" for marketing to hospitals and clinics (see FDA's notice in the January 25 *Federal Register*). The BSD unit, which is designed to treat tumors within two inches of the skin surface with electromagnetic energy, can operate at frequencies between 50-1000 MHz. It is the first hyperthermia device to win FDA approval. Two months later, on January 27, BSD followed up its first success by winning clearance for its new mobile unit, the BSD-300, which generates heat with radiation in a narrower frequency band. The portable unit uses the same technology and applicators as the BSD-1000. The devices are now available for sale by prescription, to be used under the supervision of a licensed physician.

Resources...A multinational group of researchers has devised an innovative method of removing tumor cells from bone marrow. The tumor cells are rendered magnetic by targeting them with monoclonal antibodies which are bound to polystyrene microspheres containing magnetite. The bone marrow can then be "cleaned" with a magnet. Up to

UPDATES

99.9 percent of the tumor cells can be removed with this technique, which is described in the January 14 *Lancet*....The December issue of the *IEEE Engineering in Medicine and Biology Magazine* features five papers on "Therapeutic Uses of Electrical Stimulation." Topics include pain control, growth stimulation of bones, nerves and limbs, electroacupuncture, and soft tissue healing....General Electric has published a pamphlet, *Parameters Determining the Appearance of NMR Images*. A copy is available at no charge from GE's Medical Systems Operations, PO Box 414, Milwaukee, WI 53201.

MILITARY SYSTEMS

Fourth PAVE PAWS Radar...The Air Force's Electronic Systems Division has awarded Raytheon's Equipment Division a \$61.2 million contract to build, install and test a fourth phased array, PAVE PAWS, radar near Goodfellow AFB in Texas. Last November, the AF announced plans for the third PAVE PAWS radar at Robins AFB in Georgia at a cost of \$76.9 million (see *MWN*, December 1983). Two other PAVE PAWS radars are already operational at Otis Air Guard Base in Massachusetts and at Beale AFB in California. The radars, which are more than ten stories tall, have two walls, each with 5,354 individual antennas. They can detect sea-launched ballistic missiles 3,000 miles away.

POWER LINES

Progress Report on NY Studies...The Scientific Advisory Panel of the New York State Power Lines Project will meet March 25-26 to review progress on its 16 ongoing studies. Plans for two epidemiological studies just getting under way at the University of Colorado in Denver and the Battelle Pacific Northwest Laboratory in Richland, WA, will be included in the discussions (see *MWN*, September and November 1983). The public is invited to the second day of the meeting, which will be held at the Health Department Labs in Albany. Project Administrator Michael Rampolla said that a written semiannual progress report will be released at the end of this month. For details, contact Rampolla at the NY Power Lines Project, New York State Department of Health, Center for Laboratories and Research, Empire State Plaza, Albany, NY 12201, (518) 474-7888.

Resources...A team from Hydro-Quebec's research institute, IREQ, has studied the corona, electric field and ion-current performance of a ± 900 kV bipolar HVDC transmission line. The results on radio interference, audible noise, corona loss, electric field and ozone generation are presented in the January 1984 issue of *IEEE Transactions on Power Apparatus and Systems*....A session on "Transmission Line Electric Field Effects" is scheduled for February 2 at the IEEE Power Engineering Society's winter meeting in Dallas, TX. Three presentations are planned: one on measurements of E-fields from transmission lines in residential environments by a team from Electric Research & Management; and two on methods of evaluating human exposures to 60 Hz E-fields by Dr. D. Deno of GE and M. Silva of Enertech, and by a group of Japanese researchers....The Minnesota Environmental Quality Board

(MEQB) has issued two reports on the state's ± 400 kV DC power line. *A Health and Safety Evaluation of the ± 400 kV DC Power Line*, prepared by a seven-member advisory panel, concludes that "based on currently available scientific literature, there is no indication that the Cooperative Power Association/United Power Association ± 400 kV DC power line represents a risk of effects, symptoms or damage to the health of the general public as a result of short term exposures." One of the experts filed a dissenting report. *A Statistical/Epidemiological Study of Bovine Performance Associated with the CPA/UPA DC Power Line in Minnesota* found no significant changes in milk production or quality among herds near the line. Each report is \$13.00, including handling charges, from the MEQB, 100 Capitol Square, St. Paul, MN 55101. An executive summary of each report is available free....There are now 13 gigawatts of HVDC capacity in the world, with 20 GW under construction and a projected annual growth rate of 15 percent a year through 1990, according to an article in the January issue of *IEEE Spectrum*, p.72. The report features a list of the major HVDC projects completed, built or planned around the world with a detailed map of the lines in the US....The General Accounting Office has prepared a report for the Secretary of DOE on *Expanding the Pacific Northwest/Southwest Intertie — Benefits and Impediments*. Report No. GAO/RCED-84-38, November 4, 1983 is available from GAO, Document Handling and Information Services Facility, PO Box 6015, Gaithersburg, MD 20760, (202) 275-6241.

STANDARDS

ANSI Conference...The American National Standards Institute (ANSI) is sponsoring a one-day conference on *Standards and the Law* on March 27 at the Marriott Crystal Gateway Hotel in Arlington, VA. Topics to be covered include the legality of standards, their anti-trust implications and their use in product liability cases. The registration fee is \$150. On March 28, ANSI will hold a *Seminar on Administering Domestic Standards Activities*, which has a fee of \$50. Those who register for both will receive a \$25 discount. For more information, contact Ms. Dolly McKelvey, ANSI, 1430 Broadway, New York, NY 10018, (212) 354-3300.

Oven Leakage...FDA's National Center for Devices and Radiological Health has issued a final rule on its amended procedures for measuring leaks from microwave ovens. In 1980, the Association of Home Appliance Manufacturers had objected to the FDA proposal but both sides reached an agreement in November 1981 (see *MWN*, May 1981 and January/February 1982). Now the FDA has promulgated the rule (46 *Federal Register* 57481, December 30, 1983); and it will take effect on July 2, 1984. For more information contact FDA's Melvyn Altman, (301) 443-3426.

Resources...ANSI's C63 Committee on Radio-Electrical Coordination is proposing to change its name to Committee on Electromagnetic Compatibility and to widen its scope to include setting guidelines on immunity. Meanwhile, its new

C63.12 standard *Recommended Practice on Procedures for Control of System Electromagnetic Compatibility* won official ANSI approval on December 2....The American Society for Testing and Materials (ASTM) has published its Emergency Standard Test Methods (ES 7-83) for *Electromagnetic Shielding Effectiveness of Planar Materials* (see *MWN*, October 1983). A copy is available from ASTM, 1916 Race St., Philadelphia, PA 19103, (215) 299-5400....The IEEE Standard (145-1983), *Definitions of Terms for Antennas* has been published as Part II of the November 1983 issue of the *IEEE Transactions on Antennas and Propagation*....ANSI/IEEE 539-1979, *Definition of Terms Relating to Overhead Power Line Corona and Radio Noise*, has been published and is available for \$5.00 from ANSI's Sales Dept., 1430 Broadway, New York, NY 10018, (212) 354-3300.

TECHNOLOGY

Hazeltine Wins MLS Award...The FAA awarded Hazeltine Corp. of Commack, NY, a \$90.6 million contract for the production and installation of 172 microwave landing systems (MLS) at airports across the country. As many as 1,250 MLS's are planned over the next 15 years in the US; the world market is projected to be \$2-4 billion. In winning the contract, Hazeltine beat out competing systems developed by Bendix Corp. and Wilcox Electric Corp., a subsidiary of Northrop Corp. Hazeltine is expecting to lose about \$12 million on the deal; the loss is acceptable, according to Sal Nuzzo, Hazeltine president and CEO, because it will allow the company to diversify into a non-defense market with potential for huge worldwide sales.

VDTs

Legislation...VDT bills are off to a running start in Connecticut, Ohio, Rhode Island and Massachusetts. A special panel of legislators in Connecticut met January 4 to hear the preliminary results of a VDT health and safety study or-

dered last June. Scientists from the Connecticut Academy of Science and Engineering (CASE) dismissed VDT radiation risks in their report. Speaking for CASE, Dr. Robert Handschumacher of the Yale University School of Medicine said existing radiation data "do not warrant very much more attention." Dr. Robert Wheeler, also of Yale, told the legislators that electromagnetic emissions are virtually eliminated by metallic shielding inside VDT casings. This shielding is required by FCC RFI regulations. The panel is expected to report its findings to the General Assembly by March 1. The study was ordered in a law passed last June (see *MWN*, June 1983)....In Ohio, VDT legislation sponsor Rep. Barbara Pringle testified before the Health and Retirement Committee on January 25. Pringle, whose proposal includes the right to non-VDT work during pregnancy and regular ophthalmological examinations (see *MWN*, November 1983), told *Microwave News* her legislation "would benefit employers as much as the employees" by making VDT operators more productive. More hearings are expected....Influential legislators in Rhode Island and Massachusetts introduced new bills; hearings are all but certain in both states. Rhode Island Rep. Henry Boeniger, chairman of the House Labor Committee, introduced bill H7012 with the backing of the Providence Newspaper Guild. Boeniger expects to hold a hearing in early March. Opponents of the measure, including many Chambers of Commerce in the state, say they intend to kill the bill. Massachusetts Rep. Timothy Bassett wanted to show the "wide range of policy options available" on VDT health and safety, so he introduced four bills (H3023-H3026). The weakest would establish an advisory committee to the state Department of Labor and Industries; the strongest includes mandatory standards for VDT work and periodic eye exams. Bassett, who chairs his state's Committee on Commerce and Labor, told *Microwave News* he wants to encourage a "dialogue" on VDTs but he does not expect a bill to pass this year. He plans to hold a hearing in late February.

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The first newsletter to report exclusively on video display terminal (VDT) operator health and safety has arrived. The premier issue of *VDT News* has been published. Subscribe now and we will send you the first issue by return mail. That way you won't miss an issue!

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CONFERENCES

March 8-10: NMR Imaging, Hyatt Regency, San Francisco, CA. Contact: Contemporary Forums, 219 Canyon Vista, Suite 300, Danville, CA 94526, (415) 820-2800.

March 13-14: 1984 National Radar Conference: Radar Technology for the 80's, Atlanta, GA. Contact: Dr. Edward Reedy, Georgia Institute of Technology, Engineering Experiment Station, Radar & Instrumentation Lab, Atlanta, GA 30332, (404) 424-9621.

April 3-5: 3rd Annual Test & Measurement World Expo, Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

April 4-5: 20th Annual Meeting of the National Council on Radiation Protection and Measurements, Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 14-19: 19th Annual Association for the Advancement of Medical Instrumentation Meeting and Exhibit, Washington Hilton, Washington, DC. Contact: AAMI, 1901 North Fort Myer Dr., Suite 602, Arlington, VA 22209, (703) 525-4890.

April 24-26: IEEE 1984 National Symposium on Electromagnetic Compatibility, Hyatt Regency Hotel, San Antonio, TX. Contact: William McGinnis, Southwest Research Institute, PO Drawer 28510, San Antonio, TX 78284, (512) 684-5111, ext. 2721.

April 29-May 2: 62nd Annual Convention of the National Association of Broadcasters, Las Vegas Convention Center, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036, (202) 293-3570.

April 29-May 4: 9th Conference & Exposition on Overhead and Underground Transmission and Distribution, Bartle Hall, Kansas City, MO. Contact: J.R. Miller, Kansas City Power & Light Co., PO Box 19964, Kansas City, MO 64141.

April 30-May 3: 5th Annual Meeting of the Canadian Radiation Protection Association, Banff, Alberta. Contact: Stuart Hunt, 15 Glacier Place, St. Albert, Alberta, T8N 1R7, Canada.

May 6-12: 6th International Congress of the International Radiation Protection Association (IRPA), Berlin, West Germany. Contact: Dr. R. Neider, Bundesanstalt für Materialprüfung, Unter den Eichen 87, D-1000 Berlin 45, West Germany.

May 7-9: 1984 Microwave Power Tube Conference, Naval Postgraduate School, Monterey, CA. Contact: John Skowron, Raytheon Co., Foundry Ave., Waltham, MA 02254, (617) 899-8400, ext. 4311.

May 7-11: Nuclear Magnetic Resonance 1984: National Symposium, Hyatt Regency Grand Cypress Resort, Orlando, FL. Contact: Ms. Norine Karwel, Educational Symposia, PO Box 17241, Tampa, FL 33682, (813) 879-8765.

May 20-24: 16th Annual Meeting of the Conference of Radiation Control Program Directors, Des Moines, IA. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

May 30-June 1: IEEE MTT-S International Microwave Symposium, San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 1691 Bayport Ave., San Carlos, CA 94070, (415) 594-3529. The 1984 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium will be held in San Francisco May 29-30 in conjunction with the MTT-S meeting.

June 3-8: 29th Annual Meeting of the Health Physics Society, Hyatt Regency, New Orleans, LA. Contact: Richard Burk, Jr., HPS, 4720 Montgomery Lane, Suite 506, Bethesda, MD 20814, (301) 654-3080.

June 25-28: 1984 International IEEE/AP-S Symposium and National Radio Science Meeting, Westin Hotel, Boston, MA. Contact: Professor Harold Raemer, Dept. of Electrical Engineering, Northeastern University, Huntington Ave., Boston, MA 02115.

June 26-28: 7th International Symposium and Exhibition on Electromagnetic Compatibility, Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland.

June 26-28: 1984 International Conference on Lightning and Static Electricity, Orlando, FL. Contact: J.J. Fisher, US Naval Air Systems Command, PO Box 15036, Arlington, VA 22215, (202) 692-7822.

July 2-6: 1984 Nuclear EMP Meeting, Baltimore Hilton Hotel, Baltimore, MD. Contact: Dr. Arthur Sindoris, Harry Diamond Labs, 2800 Powder Mill Rd., Adelphi, MD 20783.

July 2-6: 4th International Symposium on Hyperthermic Oncology, Aarhus, Denmark. Contact: Dr. Jens Overgaard, Institute of Cancer Research, Radiumstationen, DK-8000 Aarhus C, Denmark.

July 15-19: 6th Annual Bioelectromagnetics Society Meeting, Omni International Hotel, Atlanta, GA. Contact: BEMS, 1 Bank St., Gaithersburg, MD 20878, (301) 948-5530.

July 15-20: IEEE Power Engineering Society: 1984 Summer Meeting, Washington Plaza, Seattle, WA. Contact: Jack Richardson, Puget Sound Power & Light Co., 10608 NE Fourth St., Bellevue, WA. 98008, (206) 453-6800.

July 22-25: 21st Annual Conference on Nuclear and Space Radiation Effects, Broadmoor Hotel, Colorado Springs, CO; followed by **July 26-27: 1984 Hardened Electronics and Radiation Technology (HEART) Conference**, Fort Carson Army Base, Colorado Springs, CO. Contact for both meetings: B.D. Shafer, Sandia National Labs, Albuquerque, NM 87185, (505) 846-0629.

July 29-August 4: 8th International Biophysics Congress, Bristol, England. Contact: Meon Conferences Services, Petersfield, Hampshire GU32 3JN, England.

August 20-24: Conference on Precision Electromagnetic Measurements, Delft, Netherlands. Contact: Mrs. I.J. Smits, Department of Electrical Engineering, Delft University of Technology, PO Box 5031, 2600 GA Delft, Netherlands, 31-15-781736.

August 27-30: Open Symposium on the Interactions of Electromagnetic Waves with Biological Systems, Florence, Italy. (The symposium will be held as part of the URSI Assembly, see August 29 below.) Contact: Dr. Elliot Postow, Naval Medical R&D Command, Bldg. 142, National Navy Medical Center, Bethesda, MD 20814, (202) 295-1140.

August 29-September 5: 21st General Assembly of the International Union of Radio Science (URSI), Florence, Italy. Contact: Professor A.M. Scheggi, Istituto Ricerca Onde Elettromagnetiche (IROE), Consiglio Nazionale delle Ricerche, Via Panciatichi 64, 50127 Florence, Italy, 39-55-4378512.

September 10-13: 14th European Microwave Conference, Liege, Belgium. Contact: Microwave Exhibitions & Publishers, Convex House, 43 Dudley Rd., Tunbridge Wells, Kent TN11 1LE, England.

September 16-21: 19th Annual Microwave Power Symposium, Sheraton-Ritz Hotel, Minneapolis, MN. Contact: IMPI, Suite 520, 301 Maple Ave., Vienna, VA 22180, (703) 281-1515.

September 17-19: 37th Annual Conference on Engineering in Medicine and Biology, Los Angeles Hilton, Los Angeles, CA. Contact: Alliance for Engineering in Medicine and Biology, Suite 402, 4405 East-West Highway, Bethesda, MD 20814, (301) 657-4142.

September 18-20: 4th International Conference on Electromagnetic Compatibility, University of Surrey, Guildford, Surrey, England. Contact: Institution of Electronic and Radio Engineers, 99 Gower St., London WC1E 6AZ, England, (01) 388-3071.

October 2-4: 6th Annual Electrical Overstress/Electrostatic Discharge Symposium, Marriott Hotel, Philadelphia, PA. Contact: Burt Unger, Bell Labs, 600 Mountain Ave., Murray Hill, NJ 07974, (201) 582-2555.

October 16-18: 1984 International Symposium on Electromagnetic Compatibility, Tokyo, Japan. Contact: Professor T. Takagi, Dept. of Communications, Tohoku University, Sendai, 980, Japan, (0222) 22-1800 ext. 4266.

October 22-24: International Symposium on Noise and Clutter Rejection in Radars and Imaging Sensors, Sasakawa Hall, Tokyo, Japan. Contact: Professor T. Musha, Dept. of Applied Electronics, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama, 277, Japan, (045) 922-1111, ext. 2546.

October 22-26: 9th International Conference on Infrared and Millimeter Waves, Osaka, Japan. Contact: Professor A. Mitsuishi, Dept. of Applied Physics, Osaka University, Yamada-Oka, Suita, Osaka 565, Japan.

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Microwave News invites contributions to *From the Field*, our occasional column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

Hawaii Broadcast Radiation: EPA Finds Hot Spots

The levels of radiofrequency (RF) radiation from broadcast antennas in Honolulu, Hawaii, are the highest ever measured in an urban area. According to a recently released report by the Environmental Protection Agency (EPA), human exposures in 12 out of 21 locations exceeded the standards adopted by the state of Massachusetts and/or the limits recommended by the International Radiation Protection Association (IRPA). There are no U.S. federal standards governing non-ionizing radiation exposures for the general public.

Despite such high levels, EPA officials do not believe that RF radiation in Honolulu poses an "immediate risk," because most public exposures are "transient or intermittent." Nevertheless, Joseph Cannon, EPA assistant administrator for air and radiation, advised Mark Fowler, chairman of the Federal Communications Commission (FCC), that "it would be prudent for you to investigate how many people have access to areas with the highest fields, and how often and how long they are exposed." (See the full text of Cannon's letter in "From the Field" on p.8.)

Cannon also wrote that the EPA "intends to propose several options for limiting exposure to RF radiation" in 1985 and to issue a federal standard in 1986. (See related story on p.7.)

AM Levels Exceed ANSI Limits

Richard Tell of EPA's Office of Radiation Programs went to Hawaii with FCC's Dr. Robert Cleveland last May to measure radiation levels after years of public concern over possible health risks (see *MWN*, April 1984).

Tell identified the highest radiation levels near AM (550 kHz-1.6 MHz) radio towers. Next to a tower in Kaimuki, with one FM and three AM stations, he found maximum AM magnetic fields of 9 A/m (the plane-wave equivalent of 3,054 mW/cm²; AM fields cited below are given in terms of power densities) and FM levels of 830 uW/cm². Three AM stations at Ala Wai tower produced a field of up to 306 mW/cm² next to an access-limiting fence. In a parking lot at 331 Kamani where there are three AM stations and one FM station, levels as high as 3,261 mW/cm² were measured at the base of the tower — this area is closed to the public, however. AM levels inside a nearby clothing store were 23.9 mW/cm² near a floor fan and a machine that applies labels. The report notes that the machine caused RF burns.

The levels of very high frequency (VHF) (30-300 MHz) radiation associated with the FM and TV stations were generally below 1 mW/cm² in public areas. Four readings did exceed 1 mW/cm² in locations accessible only to maintenance personnel — the highest VHF reading, 20 mW/cm², was on the roof of the Ala Moana Hotel.

Tell also visited outdoor recreation and sun bathing areas on the top of high-rise apartment buildings that are near broadcast antennas. For instance, on the rooftop of the Villa on Eaton Square, opposite the Ala Wai tower, Tell measured AM levels greater than 24 mW/cm²; and at an

(continued on p.4)

Chromosomal Breaks Among Power Substation Workers

A team of Swedish researchers has identified unusually high rates of chromosomal abnormalities among power substation workers exposed to electromagnetic fields. Further laboratory research showed that spark discharge pulses caused chromosomal breaks, but that 50 Hz fields had no genetic effects on human lymphocytes.

Drs. I. Nordenson and S. Nordstrom of the University of Umea, Dr. K. Hansson Mild of the National Board of Occupational Safety and Health and E. Birke of the Swedish State Power Board in Vallingby observed an increased frequency of chromosomal breakage in a group of switchyard workers exposed to an EM field from a 400 kV system. Their *in vitro* study suggests "that exposure to electric fields (50 Hz, 1 mA/cm² current density in the blood sample) does not induce chromosomal damage in peripheral lymphocytes. However, when the exposure was in the form of repeated transient current (ten 3 usec-long pulses with 2.5-3.5 kV/cm peak [electric field] in the sample) a significantly increased frequency of chromosomal breaks was found."

Two of the co-authors, Nordstrom and Birke, have previously shown that the children of men who work in high voltage substations had an increased rate of congenital malformations (see *Bioelectromagnetics*, 4, 91, 1983, and *MWN*, March 1983). The new *in vivo* and *in vitro* investigations were designed to follow up that 1983 epidemiological study.

Analysis of the chromosomes of the substation workers' lymphocytes revealed no increase in gaps but highly significant increases in the rates of chromatid and chromosome breaks (p less than 0.0005), with a fivefold increase in chromosome breaks overall, compared to controls.

The frequency of chromosomal breaks in the *in vivo* study was similar to that induced in lymphocytes by ionizing radiation at a dose of 0.75 Gray (Gy), according to the researchers' paper, which appears in *Radiation and Environmental Biophysics*, 23, 191, 1984. (0.75 Gy is equivalent to 75 rads and is considered to be a large, though not a life-threatening, dose.)

A previous study, published in the same journal (19, 235, 1981) by a West German team headed by Dr. M. Bauchinger, failed to uncover any chromosomal changes in workers who had been exposed to 50 Hz fields in 380 kV switchyards for more than 20 years.

During a recent visit to the U.S., Dr. K. Hansson Mild told *Microwave News* that the Swedish team had also recently completed a well-controlled, follow-up study of 19 exposed non-smoking switchyard workers and that the results were the same as in the previous study.

"This constitutes a pretty clear case that spark discharges cause chromosomal damage," Mild said. It is not so much the fields, but the discharges that cause problems, he explained.

According to Mild, the discharges can easily be controlled through grounding.

Immunity Task Group: TVs, VCRs and Cordless Phones

An ad hoc working group is nearing completion of a report on its efforts to enhance the immunity of televisions and video cassette recorders (VCRs) to conducted and radiated interference. The group, which works under the aegis of the American National Standards Committee C63 on Electromagnetic Compatibility, formed a new subcommittee to study the immunity of cordless telephones, and plans are underway to broaden the group's inquiry to include security devices.

Don Heirman, chairman of the ad hoc group, said in a telephone interview that an interim status report describing voluntary standards for the immunity of TVs and VCRs will be presented to the IEEE Standards Board at its March meeting.

The public availability of the report will be decided by the board in March, according to Heirman, who is with AT&T Information Systems in Holmdel, NJ. The final report is due by the end of 1985.

The working group is keying its proposed immunity limits to those developed by the Electronic Industries Association (EIA). Three types of electromagnetic interference (EMI) are being addressed: (1) interference received along with the desired signal; (2) direct radiation; and (3) conducted interference by the power cord and other leads.

The first type is addressed in EIA Interim Standard No.10, *Immunity of TV Tuners to Internally Generated Harmonic Interference from Signals in the Band 535 kHz-30 MHz*, which is an expanded version of the 1980 EIA Bulletin No.8A, *Susceptibility of TV Tuners to Harmonically Generated Interference*. The 8A bulletin covered only CB radiation; No.10 includes AM radio up to 30 MHz. Eb Tingley of EIA's Consumer Electronics Group said that the new standard, which has already been published, will likely go into effect on January 1, 1986.

EIA's Proposed Interim Standard No.16, *Immunity of Television Receivers and Video Cassette Recorders to Direct Radiation from Radio Transmission, 0.5-30 MHz*, seeks to limit radiated EMI. Tingley said that this proposal, which is being voted on by the association's members, would require TVs and VCRs to withstand radiated fields of 1 V/m. (Last spring, EIA raised the possibility of using an immunity level of 3 V/m, but this was rejected by manufacturers as being too strict (see *MWN*, June 1984).

Conducted EMI from the power cord and other leads is being studied by the National Bureau of Standards (NBS) under an EIA contract. According to Tingley, the NBS will also evaluate proposed Special Committee on Radio Interference (CISPR) procedures for measuring conducted interference. The NBS report will not be ready until late 1985.

The ad hoc working group was set up to meet the Congressional mandate of reducing EMI to electronic equipment used in the home as defined in the Communications Act Amendments of 1982, P.L. 97-259 (see *MWN*, September and October 1982). The group is overseeing the development of voluntary immunity standards to forestall

mandatory FCC limits (see *MWN*, May 1983). The Federal Communications Commission's Frank Rose and Dan Yates are working with the ad hoc group.

Cordless Phones

The subcommittee on cordless phones is now trying to pick an independent laboratory to test the susceptibility of units to amateur radio signals. The phones operate at 46-49 MHz, and there is an amateur band at 50-54 MHz, which might cause objectionable EMI.

According to subcommittee member Jay Padgett of AT&T Consumer Products Labs in Neptune, NJ, no decision has yet been made on what data should be collected.

Padgett pointed out that the 49 MHz cordless phones have been on the market for some time, with virtually no interference complaints. Had there been a problem, the industry would have heard something by now.

Eric Schimmel of EIA's Information and Telecommunications Technologies Group agreed with Padgett: "We don't anticipate any problems showing up in the lab tests."

Heirman said that his ad hoc working group will begin addressing the immunity of burglar alarms and other security devices later this year.

VDTs and Problem Pregnancies: Research Underway

The possible link between video display terminals (VDTs) and miscarriages and birth defects is being intensively studied in the U.S. and Europe.

NIOSH Study

Researchers at the National Institute for Occupational Safety and Health (NIOSH) have eliminated half of a planned two-part study of VDTs and reproductive risks, and the remaining part of the project is in limbo while agency officials consider whether it can produce useful information.

NIOSH researchers originally designed the epidemiological study to include both prospective and retrospective components. For the prospective portion, which has been dropped, NIOSH had intended to follow the reproductive histories of approximately 4,000 female telephone operators for two years. The study population would have consisted of 2,000 women working with VDTs and a control group of women using single-line, light-emitting diode (LED) displays. In the retrospective part, NIOSH plans to ask the same women to describe their health and reproductive histories for the last two-and-a-half years.

NIOSH was forced to abandon the forward-looking component when representatives of the three telephone and telecommunication companies scheduled to participate announced that the LED operators would soon begin using VDTs, invalidating their role as controls. The announcement came at a meeting held at NIOSH offices in Cincinnati, OH, on December 17 to review the study protocol.

Teresa Schnorr, the lead researcher on the project, said

in a subsequent telephone interview that it would have been "preferable" to do both parts of the study and that the agency will now decide whether to do the historical component or nothing at all. But Dr. Jane Gordon, who headed the study until she left the agency in June, told *Microwave News* that the retrospective research "will be of very, very limited use" and will not add much to what is already known. Gordon is now a part-time consultant to the Communications Workers of America.

Meanwhile, the protocol for the retrospective part of the study has come under fire from both industry and labor groups. Industry groups are complaining that NIOSH should look at other occupations, not just telephone operators, to ensure that the results can be generalized to other VDT-based jobs. Union officials want more attention placed on stress and equipment design as possible causes of reproductive abnormalities.

NIOSH will not measure radiation levels or try to determine whether radiation emissions might affect pregnancies. Agency officials downplay possible health effects caused by VDT emissions, including very low frequency (VLF) fields.

Agency officials have not yet set a starting date for the study, but Schnorr hopes to begin distributing questionnaires by late summer.

Other Developments

Researchers elsewhere are also focusing on the VDT-problem pregnancy issue.

- Dr. William Butler, an epidemiologist at the University of Michigan at Ann Arbor, announced at the December 17 NIOSH meeting that he and Dr. Kelley Brix are planning a retrospective epidemiological study of VDTs and reproductive risks. Butler said that they "will cover different ground" than NIOSH. He would not comment on their funding sources or study populations.

- Researchers at Finland's Institute of Occupational Health in Helsinki found no evidence that VDT work can cause birth defects. Using listings in the national birth registry and a limited number of questionnaires, Drs. Kari Kurpa, Peter C. Holmberg, Kaarina Rantala and Tuula Nurminen concluded that working at VDTs produces no increase in the rate of reproductive abnormalities among exposed women. Thus, the authors report in the December 8, 1984 issue of *Lancet* that "our results do not give support to rumors that exposure to VDTs causes birth defects." Responding to this and other VDT research, *Lancet* editorialized on January 12 that continued research "will probably dissipate many of the general fatigue symptoms [reported by operators], and with them will go much of the anxiety about radiation. Much, but never all of the anxiety; where the health of so many is involved, unruffled vigilance is a good prescription."

- A statement has been issued from the first international conference on VDTs and reproductive risks, held November 29-30 in London, England. The meeting, which was closed to the public and the press, brought together re-

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searchers from Europe, Canada and the U.S. In a summary statement, conference organizers report that: "...there was general agreement among the panel of expert speakers that the investigations which have been carried out throughout the world — involving both the measurement of emissions from VDTs and the study of groups of operators to see if they have suffered any ill effects — have failed to confirm that the alleged harmful effects are attributable to VDT work. However, there was also general agreement that further surveys and research were justified given the complex and emotive nature of the allegations." A copy of the statement can be obtained from Humane Technology, PO Box 2, Quorn, Nr. Loughborough, Leicestershire LE12 8EG, England. Also available is a complete set of the papers presented at the meeting. It costs 15 pounds in Europe and 16.50 pounds elsewhere (prepaid, price includes postage).

- A NIOSH investigation of a problem pregnancy cluster at Southern Bell's offices in Atlanta, GA, confirmed that a cluster existed but did not find its cause (see *MWN*, April and May 1984). In a report released in late January (HETA 83-329-1498), NIOSH explained that maternal age, VDT use and time spent standing were ruled out as possible agents for the 43 percent miscarriage rate (6 of 14 pregnancies) that occurred among workers on the fifth floor of one of the company's buildings. This is one of three ongoing NIOSH investigations of possible problem pregnancy clusters and the first for which a report has been completed.

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(continued from p.1)

open access area on top of the Coty Tower he measured VHF power densities of up to 663 $\mu\text{W}/\text{cm}^2$.

Readings were generally lower inside buildings than in the open air because, EPA points out, walls and roofs attenuate the radiation. At VHF frequencies, the two highest indoor readings were 27-60 $\mu\text{W}/\text{cm}^2$ in an apartment on the 10th floor of Coty Tower and 40 $\mu\text{W}/\text{cm}^2$ in the restaurant at the Ala Moana Hotel. These power densities do not exceed any current guidelines used in the U.S., though they are higher than the Soviet Union's standard for the general population.

The radiation levels cited in the report are approximate. Tell cautions that they are accurate within a factor of plus or minus 2 decibel: "This corresponds to a possible uncertainty of +58 percent and -37 percent in the stated power densities and a possible uncertainty of +26 percent and -21 percent in the stated electric or magnetic field strengths. For example, a stated power density of 500 $\mu\text{W}/\text{cm}^2$ could in reality be as low as 315 $\mu\text{W}/\text{cm}^2$ or as high as 790 $\mu\text{W}/\text{cm}^2$."

Reactions in Hawaii

The release of the EPA report caught most people in Honolulu by surprise. "I got no warning that they were going to release the report," said City Councilmember

FCC Action on RF/MW Radiation Expected Soon

The Federal Communications Commission (FCC) is expected to reach a decision soon on its proposed rules on radiofrequency and microwave (RF/MW) radiation hazards. An FCC staffer said the commission may issue a ruling following its February 14 meeting or soon thereafter.

If the FCC decides to make radiation safety a factor in evaluating environmental risks, it will probably base its guidelines on compliance with either the American National Standards Institute (ANSI) or Occupational Safety and Health Administration (OSHA) standards.

Final action on Docket No. 79-144 has been pending since early 1982, when the FCC proposed a requirement that applicants for new facilities complete an environmental assessment, and possibly an environmental impact statement, if workers or the public could be exposed to radiation levels above 10 mW/cm^2 . The rules are designed to meet the commission's obligations under the National Environmental Policy Act (see 47 *Federal Register* 8214, February 25, 1982 and *MWN*, March 1982).

The broadcast and communications industry used the proposal as an opportunity to urge the FCC to preempt state and local RF/MW radiation standards. Some commenters advised the commission to adopt the 1982 ANSI limits; others suggested staying with the more lenient 10 mW/cm^2 OSHA standard (see *MWN*, September 1982).

Marilyn Bornhorst, who has expressed concern about radiation exposure.

The EPA report, *Radiofrequency Radiation Measurement Survey, Honolulu, Hawaii, May 14-25, 1984*, was handled with great sensitivity within the agency. Although it was completed last June, EPA delayed release until January while staffers wrote an accompanying "Background Information" fact sheet. Agency officials, one from Washington, DC, and one from the regional office in San Francisco, CA, went to Hawaii to hand deliver the report to key state and local officials and to answer questions.

"I wish we had better data on whether the ANSI standard is safe," Bornhorst said, referring to the guidelines set by the American National Standards Institute in 1982. She added that "I would feel a lot safer if we were following the Portland standard." The city of Portland, OR, has the strictest RF standard in the U.S.

Robert Hall of the Hawaii Institute for Biosocial Research in Honolulu said that he was "shocked" by the disparity between EPA's press release and the numbers in the actual report. He echoed Bornhorst's opinion of the ANSI standard: "We are not going to listen to ANSI." Hall had been pressing EPA to come to Hawaii to assess radiation risks since 1977.

(In its press release, EPA officials said that they do "not

believe that the levels of RF radiation measured at the Honolulu sites pose an immediate risk to the public because it is likely that most exposures are brief or intermittent and few, if any, people are likely to be exposed continuously to the highest levels." Similarly, an FCC press release said: "It was pleased to announce that the results of the study have shown that radio and TV signals in Honolulu do not pose an immediate danger to the public."

(In its background paper, EPA concludes that heating is the primary health effect of RF radiation. With respect to low-level effects, the agency wrote: "The scientific literature also contains evidence intimating non-thermal effects from RF radiation, but this is unproven." And: "A recent study said to show a non-specific increase in tumors and adrenal effects in laboratory animals chronically exposed at 0.4 W/Kg of RF radiation needs to be analyzed in depth" (see *MWN*, July/August 1984).)

Congressman's AM Station

The family of Democratic Congressman Cecil Heftel owns KSSK-AM, which broadcasts from a tower that produces one of the hot spots reported by the FCC. The radio station is located at Ala Wai Tower, where EPA measured levels of 306 mW/cm² near the tower's access-limiting fence.

Ted Bornstein, the congressman's administrative assistant, refused to comment on Heftel's personal business affairs. According to the 1983 *Broadcasting Yearbook*, KSSK is owned by Heftel Broadcasting Corp., of which Cecil Heftel is president. The congressman's district includes Honolulu.

Earl McDaniel, KSSK's general manager, said that he had read the EPA report and that he was pleased to find out that no one is in danger. With respect to remedial actions, he said that the station would look to the FCC.

Councilmember Bornhorst said that her staff is looking into the possibility of proposing an exposure standard for Honolulu. In the meantime, she is urging EPA to set national limits. In addition, Hall said that he and his associates are preparing their own report on radiation exposures in Honolulu.

Both Bornhorst and Hall cited past government deception over pesticide contamination in the state and raised the possibility that EPA was repeating the same errors, thereby risking its credibility on the radiation safety question.

Current Standards

EPA had been planning to propose RF radiation limits of 100 uW/cm² for the VHF band and 10 mW/cm² for AM frequencies before internal agency disputes stalled the proposal in June of 1984 (see *MWN*, June and July/August 1984). These levels are ten times stricter than the 1982 ANSI limits for both occupational and public exposures — 1 mW/cm² and 100 mW/cm² at VHF and AM frequencies respectively (see *MWN*, September 1982).

In 1983, IRPA approved limits for the general public of 200 uW/cm² (VHF) and 2 mW/cm² (AM) (see *MWN*, March 1984). And in 1984, the Johns Hopkins University

Applied Physics Laboratory set occupational standards of 100 uW/cm² for VHF and 10 mW/cm² for AM frequencies (see *MWN*, December 1984).

The state of Massachusetts has its own standard: 200 uW/cm² for VHF and 20 mW/cm² for AM — designed to be five times stricter than the ANSI limits (see *MWN*, September 1983). In 1980, Portland, OR, set its own — and the strictest — standard: 100 uW/cm² for VHF and 500 uW/cm² for AM.

At the 21 Honolulu sites where measurements were made, 5 locations (3 AM, 2 VHF) were in excess of the ANSI standard, 11 would violate the Massachusetts standard (6 AM, 7 VHF), and 12 would exceed the IRPA limits (7 AM, 7 VHF). In some locations, both VHF and AM standards were exceeded. Most of the sites are publicly accessible, though only two of the AM readings that were above the ANSI limits were in public spaces. EPA points out that all the locations are near antennas and were picked because they were believed to have the strongest RF fields. EPA also notes that the fields fall off quickly with distance.

Based on previous field studies, EPA has estimated that less than one percent of the U.S. population is exposed to more than 1 uW/cm².

Remedial Work Underway

Steps have already been taken to limit exposures near the two publicly accessible AM towers where fields exceed the ANSI standard. William Hassinger, engineering advisor to the chief of the FCC's mass media bureau, told *Microwave News* that the commission is in contact with representatives of the owners of the radio stations and that remedial action is underway.

In one case, Hassinger said, the station owns the affected land and a fence probably will be erected to bar public access. In the second case, a solution may take

Other Radiation Hot Spots

While local zoning laws that force broadcasters to put their antennas in populated areas make downtown Honolulu a special case, there are many other locations in the United States where the public may also be exposed to radiation levels in excess of the ANSI standard.

EPA's Richard Tell said that there are "localized hot spots" throughout the United States. In a telephone interview from his office in Las Vegas, NV, Tell said that he had a computer printout listing about 200 FM stations which can, according to calculations, produce general public exposures greater than the ANSI standard.

Tell recommended that fences be built to block public access to some of these hot spots. "We should go out and identify the worst case exposure locations and tell people where the unacceptable levels are," Tell said.

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longer because the property is leased. Hassinger described the owners as "eager to help and resolve the problem."

An FCC press release stated that "any plans or proposals developed by the FCC likely will be highly individualized and will require a great deal of cooperation by all parties concerned."

The FCC has no formal rules governing occupational and public exposure to non-ionizing radiation. Hassinger said that the commission was gauging health risks on the basis of the ANSI limits.

The National Association of Broadcasters (NAB) also said that the stations involved were cooperating to resolve the problem. NAB President Edward Fritts called the Hawaii situation an "isolated and unique" case because broadcast towers are rarely located in inhabited areas.

In a press release, Fritts said that the NAB favored the ANSI standard and asked the federal government to adopt it to "assuage unwarranted public concern and eliminate unnecessary confusion at the state and local level." He noted that, "For more than 50 years, broadcasters have provided communications services...with absolutely no evidence of harm."

The Electromagnetic Energy Policy Alliance (EEPA) also urged the federal government to adopt the ANSI standard. In a press release, the trade group stated that, "The EPA survey results confirm that the Honolulu general public is in no danger from exposure to RF fields generated by radio and television broadcasting."

Beyond ANSI

While the two AM towers should be able to meet the ANSI limits without incurring large costs, Honolulu broadcasters would have more difficulty conforming to tougher limits, like the EPA's stalled 100 $\mu\text{W}/\text{cm}^2$ proposal.

Although EPA could set a standard as early as next year (it may not be 100 $\mu\text{W}/\text{cm}^2$; indeed, EPA may decide a standard is not needed), very little planning is underway to meet limits which are stricter than ANSI's.

FCC's Hassinger believes that a long-term solution will probably be needed. "Wholesale relocation" of the antennas would be good, if feasible, he said, with the goal of "putting some distance between transmitters and people."

At the NAB, Tom Keller, vice-president for science and technology, said that he could not predict whether stricter standards than ANSI's would be adopted or how broadcasters would react to such measures. He said that it is in the

broadcasters' best interests to make the antennas more efficient, which would be the case if the towers were placed on the hills overlooking Honolulu.

At present, local laws prevent broadcasters from siting antennas on the adjacent hills, forcing the towers to be built in the middle of the city.

Shock and Burn Hazards

In the course of taking survey measurements, Tell responded to an FCC request to investigate accounts of window washers at high-rise buildings receiving RF burns from the long, metal cables that support their platforms. In one experiment, Tell measured almost one half ampere of current in a cable (extending from the roof of the Villa at Eaton Square), even though the ground level electric field strengths were only 1-2 V/m. According to the EPA report, "it was not possible to measure the open-circuit voltage on the cable, but the voltage was sufficient in strength to produce electrical arcs from the cable to grounded objects."

The report goes on: "Under these particular conditions, (the presence of conductors such as metal cables in low frequency fields), the RF burn phenomena is difficult to control...and shocks and burns present a real hazard for window washers using metal cables. Depending on whether metal cables are hung in close proximity to flammable materials (cloth awnings, grass, brush) or close to street level, fire hazards and/or shocks or burns to passersby inadvertently touching cables might be possible."

EPA has referred the matter to the Occupational Safety and Health Administration (OSHA). In a telephone interview, Bob Curtis of OSHA's Health Response Team in Salt Lake City, UT, acknowledged that metal cables create a shock risk, but explained that non-conducting cables cannot be used because of other OSHA rules.

(As noted earlier, in his report Tell cites a case of a label machine causing RF burns inside a store near a broadcast tower.)

There have also been reports of longshoremen receiving RF burns while working near cranes on docks half a mile from an AM radio tower. And Councilmember Bornhorst said that she knew of a report of sparks causing a fire in garbage at the bottom of an elevator shaft. Hall also said that he knew of a spontaneous fire near a broadcast tower.

Anecdotal stories of neurological disorders and other health complaints among residents of apartment buildings near broadcast towers are also circulating. These could not be confirmed and no health studies have been done.

OSHA's Curtis said that he had also been to Hawaii to take measurements last year but that he had not investigated commercial broadcast sources. He took readings near the Navy's Omega antenna and its communications station at Lualualei (see *MWN*, July/August 1982). Curtis said that his report would be completed in about six weeks.

For a copy of the Hawaii report, contact: Office of Radiation Programs, EPA, 401 M Street, SW, Washington, DC 20460. ●

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EPA Plans To Issue RF/MW Standard in 1986

The Environmental Protection Agency (EPA) now plans to issue federal limits in 1986 for public exposure to radiofrequency and microwave (RF/MW) radiation. The agency's schedule is cited in a letter from Joseph Cannon, EPA Assistant Administrator for Air and Radiation, to Mark Fowler, chairman of the Federal Communications Commission, which accompanied the release of an EPA report on radiation levels in Honolulu, Hawaii (see story on p.1 and the complete text of the letter on p.8).

In his January 22 letter, Cannon wrote that in 1985 EPA will "propose several options for limiting exposure to RF radiation." Among the listed possibilities are a 100, 200 or 1,000 uW/cm² standard. The agency may also decide that public exposure can be controlled without a standard.

Cannon also said that he anticipated reaching a decision on a national RF/MW radiation standard in 1986.

David Janes, of EPA's Office of Radiation Programs (ORP) in Washington, DC, confirmed this schedule in a

telephone interview with *Microwave News*.

EPA plans to propose limits last summer were stalled by dissent within the agency, principally from the Office of Policy Planning and Evaluation (see *MWN*, June and July/August 1984). In the fall, ORP Director Sheldon Meyers said that EPA would go to the *Federal Register* to obtain more information in an effort to decide on a preferred course of action (see *MWN*, October 1984).

EPA has now combined two steps: the agency will ask for outside opinions and propose a standard at the same time. Janes explained that the agency could save a year using this approach.

Informed sources note, however, that there is little chance a standard could emerge without a strong commitment from the new EPA administrator, Lee Thomas, because of longstanding opposition from the agency's policy office.

Cannon also told Fowler that later this year EPA would issue an economic analysis of the costs to broadcast sources of complying with RF/MW standards. The analysis is being prepared by the Lawrence Livermore National Laboratory (see *MWN*, January/February 1984).

CONFERENCES

March 5-7: **6th Symposium & Technical Exhibition on Electromagnetic Compatibility**, Zurich, Switzerland. Contact: EMC Symposium & Exhibition, ETH Zentrum-IKT, 8092 Zurich, Switzerland, 256-27-90.

March 20: **Symposium on Vision in the High Tech Society**, Sheraton Washington Hotel, Washington, DC. Contact: American Optometric Association, 243 N. Lindbergh Blvd., St. Louis, MO 63141, (314) 991-4100.

March 21-22: **IMTC/85: Instrumentation/Measurement Technology Conference**, Hyatt Regency, Tampa, FL. Contact: Dr. Robert Ashley, Sperry Corp., PO Box 4648, Clearwater, FL 33518, (813) 577-1900, ext. 2228.

March 22-26: **3rd Annual Meeting of the Society for Magnetic Resonance Imaging**, Town & Country Hotel, San Diego, CA. Contact: SMRI, 1340 Old Chain Bridge Rd., Suite 300, McLean, VA 22101, (703) 790-1745.

April 3-4: **21st Annual Meeting of the National Council on Radiation Protection and Measurements**, Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 14-17: **63rd Annual Convention of the National Association of Broadcasters**, Las Vegas, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036, (202) 293-3570.

April 16-17: **8th International Colloquium on the Prevention of Occupational Risks due to Electricity**, London, UK. Contact: International Fire Security & Safety Exhibitions & Conferences Ltd., Cavendish House, 128/134 Cleveland St., London W1P 5DN, UK, (01) 387-5050.

April 16-19: **4th International Conference on Antennas and Propagation (ICAP 85)**, Coventry, UK. Contact: Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, UK, (01) 240-1871, ext. 222.

April 17-19: **3rd International Conference on Developments in Power System Protection**, London, UK. Contact: IEE, see April 16 above.

SHORT COURSES

March 18: **Electrostatic Discharge (ESD) Control**, Dallas, TX. Fee: \$295. Contact: R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1960.

March 18-20: **Dielectric Resonators**, Oxford, MS. Fee: \$550. Contact: Division of Continuing Education, University of Mississippi, University, MS 38677.

March 18-21: **Elements of Phased Array Radar System Design**, Atlanta, GA. Fee: \$750. Contact: Dept. of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332, (404) 894-2400.

March 18-22: **TEMPEST-Design, Control & Testing**, Washington, DC. Fee: \$1175. (Secret Security Clearance Required.) Contact: DWCI, Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

March 20-21: **Electromagnetic Pulse (EMP) Design and Test**, Dallas, TX. Fee: \$595. Contact: R&B, see March 18 above.

March 25-26: **Lightning Protection**, Orlando, FL. Fee: \$650. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773 or (202) 676-6106 in DC. Repeated August 12-13: Washington, DC.

April 1-4: **Computational Methods in Electromagnetics**, Monterey, CA. Fee: \$750. Contact: Ann Beekman, SCEEE, 11th & Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

April 15-18: **Modern Microwave Measurements**, Palo Alto, CA. Fee: \$895. Contact: Continuing Education Institute (CEI), 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545 or (301) 596-0111. Repeated May 13-16: Alexandria, VA.

April 15-19: **Laser Microwave Hazards Course**, Aberdeen Proving Ground, MD. Fee: NA. Contact: Mrs. Donley, US Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD 21010, (301) 671-4158.

May 6-10: **Radiation Safety**, Evanston, IL. Fee: \$895. Contact: Continuing Engineering Studies, 2804 Technological Institute, Northwestern University, Evanston, IL 60201, (312) 492-3365.

FROM THE FIELD

EPA Letter to FCC on Hawaii Broadcast Radiation

Reprinted below is the complete text of the January 22 letter from Joseph A. Cannon, assistant administrator for air and radiation at the Environmental Protection Agency (EPA) to Mark S. Fowler, chairman of the Federal Communications Commission (FCC), accompanying the EPA report on the levels of broadcast radiation in Honolulu, Hawaii.

Dear Mr. Fowler:

At your request, a joint EPA and FCC study was conducted in May 1984 to measure the intensity of radiofrequency (RF) radiation fields in the vicinity of broadcast stations in Honolulu, Hawaii. I am happy to provide you with the enclosed report that summarizes the results of these field measurements.

In the study, measurements were made only in areas near antennas, and almost all of the broadcast towers in Honolulu were included. The survey locations are representative of places in Honolulu where public exposures to RF radiation fields are believed to be highest. The results show that public exposures in 12 out of the 21 survey locations exceed limits currently proposed, recommended, and/or adopted by several scientific and technical advisory organizations or regulatory bodies. Because of the combination of exposure levels and public accessibility, at least two of the locations may warrant further evaluation. The measurements and various exposure guidelines are discussed in the report.

RF radiation can produce various biological effects. Most studies use experimental animals exposed for relatively short periods of time, rather than long-term continuous exposures, and few health studies of people have been done. At relatively high levels, health effects are due to heating of cells and tissues, and increases in temperature are dependent on duration of exposure. At lower levels of exposure, the public health significance of experimentally observed effects is not well understood.

Although there are many uncertainties in our current understanding of how exposure to RF radiation affects human health, it is possible to interpret the meaning of the observed biological effects in terms of the potential for adverse health effects in exposed people and to identify subgroups in the population who may be particularly sensitive. Such an interpretation is presented in the enclosed fact sheet. The fact sheet also gives other background information on the survey, and it will be distributed to the public and members of the press who may request the report from us.

We do not believe that the levels of RF radiation measured at the Honolulu sites pose an immediate risk for the following reasons. Field intensities tend to drop off rapidly as distance from the source increases. In general, beyond about 100-150 feet from the base of antenna towers, people are exposed to low levels, typically below 100 microwatts per square centimeter or about 0.04 watts per kilogram of body mass.... The highest levels measured in this survey were outdoors in close proximity to the towers, on rooftops, or in areas with access normally limited to maintenance personnel or other workers. Indoor fields are generally low because of shielding by the walls and roofs of buildings. Consequently, it is likely that most exposures are transient or intermittent, and few people are likely to be exposed continuously to the highest fields. However, it would be prudent for you to investigate how many people have access to areas with the highest fields, and how often and how long they are exposed.

I understand that the Commission, in cooperation with local

authorities, will decide if and what corrective actions may be needed in Honolulu. I recognize that the results of this study are difficult to interpret in the absence of the Federal Guidance you have requested from EPA. In 1985, EPA intends to propose several options for limiting exposure to RF radiation. The options encompass the range of limits recommended or adopted by various advisory groups such as the International Radiation Protection Association (IRPA) and the American National Standards Institute (ANSI), and include:

1. Controlling public exposure by limiting whole-body average specific absorption rates (SAR) to 0.04 watts per kilogram (W/Kg) for frequencies above 3 Megahertz (MHz) and to 87 volts per meter (V/m) or 0.23 Amperes per meter (A/m) at frequencies below 3 MHz.
2. Controlling public exposure by limiting whole-body average SARs to 0.08 W/Kg for frequencies above 3 MHz and to 275 V/m or 0.73 A/m for frequencies below 3 MHz.
3. Controlling public exposure by limiting whole-body average SARs to 0.4 W/Kg for frequencies above 3 MHz and to 614 V/m or 1.63 A/m for frequencies below 3 MHz.
4. Other possible options, including not establishing Federal Guidance for RF radiation.

I anticipate that we will reach a decision on establishing Guidance in 1986. But, in the absence of formal EPA Guidance, you should at least consider evaluating the two publicly accessible locations in Honolulu where the measured exposure levels exceed the third option level listed above. In addition, we will be glad to help you with additional analyses you may undertake such as calculating exposures at various distances from the towers or identifying techniques (fencing, posting, and/or shielding, etc.) that can be used to limit public access to the higher fields near antenna towers.

We have just published a review of the biological effects of radiofrequency radiation, and various other background documents will also be made available to the public in 1985:

- Radiofrequency radiation in the environment — sources and levels of exposure (Office of Radiation Programs, EPA).
- An estimate of the potential costs of guidelines limiting public exposure to RF radiation from broadcast sources (Lawrence Livermore National Laboratory).
- Assessing the potential impact of Federal radiation safety regulations on AM, FM, and TV broadcast sources (Office of Radiation Programs, EPA).

If you have any questions about the report, please feel free to call me at 382-7400.

Sincerely,

Joseph A. Cannon

VDT Radiation Measurements at SRI International

The following communication was sent to Microwave News by Jane Clemmensen, a research engineer at SRI International. Clemmensen's letter is dated October 11.

We would like to provide additional data relative to the article on VDT flyback radiation (*MWN*, September 1984). Our comments will be restricted to Dr. Guy's data since the EPA measurements were peak rather than rms average fields. We did not measure rise and fall times of the horizontal sweep oscillator. We measured the vertical component of the electric field (E_z) and one or more components of the magnetic field (B_x , B_y , B_z). Unless

otherwise noted B-field values given are for the total B vector.

Our data on VDTs are consistent with Guy's range of rms magnetic fields (25-175 nT [nanotesla] or 0.02-0.14 A/m) which he measured 25-30 cm from the screen. We measured fields 30 cm in front of the screen of an old Heathkit terminal and found the magnetic field at the flyback frequency, 15.5 kHz, to be 63 nT (0.05 A/m). The B-field 40 cm away from the rear of the VDT was 13 nT (0.01 A/m). Our electric field data are not in agreement with Guy's generalization that E-fields measured 25-30 cm from the screen are typically 5 V/m for new VDTs and 50 V/m for older VDTs. We measured a 1.5 V/m electric field at 15.5 kHz at a distance 30 cm from the front of the screen of an old Heathkit terminal. More measurements on a number of different VDTs are clearly indicated before generalizations can be made.

Any discussion of fields from VDTs should also include television sets because they display similar spectral features and produce VLF emissions. The horizontal sweep frequency is standard-

ized in TV sets at 15.7 kHz. In VDTs the flyback frequency varies with make and manufacturer. The electric and magnetic fields originating from the flyback transformers of VDTs and TV sets are also accompanied by strong electric and magnetic fields at harmonics of the 60 Hz power line frequency. The magnitude of harmonic fields is approximately equal to the fields from the flyback transformer. 60 Hz harmonic fields therefore must be measured in addition to VLF radiation.

Our measurements of TV sets were made 1 m in front of the set at the height of a sitting child's head, 0.7 m above the floor. Electric fields at 1 m ranged from 1 V/m for a Sony TV to 3 V/m for an RCA. The single-axis magnetic field 1 m in front of the Sony was 1 nT (8×10^{-4} A/m) for the By orientation. The magnetic field from the RCA TV was 0.5 nT (4×10^{-4} A/m) for the By orientation and 1.5 nT (1.2×10^{-3} A/m) for the Bx orientation.

Jane M. Clemmensen, Research Engineer
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UPDATES

BIOLOGICAL EFFECTS

ELF Research at Tulane...A group at the Electrosience and Biophysics Research Lab at Tulane University in New Orleans, LA, has been studying the effects of chronic exposure to high intensity electric fields for EPRI. The experiments were completed in 1982; shortly thereafter, the principal investigator, Dr. Y.J. Seto, died. The other members of the research team are Drs. William Dunlap, S.T. Hsieh, John Lymangrover, Deborah Majeau-Chargois and Cedric Walker. They have published a number of papers describing the results of their multi-generation study. In general, they did not identify any gross effects, though they did find a number of subtle interactions. Exposing rats to 80 kV/m unperturbed 60 Hz electric fields for 42-240 days (a mean of 125 days) resulted in enhanced growth in the long bones, causing both increased length and mass (*Journal of Bioelectricity*, 1, 339, 1982). Exposure for 120 days from conception caused no changes in food and water intake, but there was a statistically significant effect on the pattern of growth, "suggestive of a slight initial developmental delay" (*Journal of Bioelectricity*, 2, 197, 1983). The same 120-day exposure period caused no changes in body chemistry metabolism, as measured by 17 serum chemistry assays (*Journal of Environmental Science and Health*, A19, 865, 1984). Exposing four generations of rats to 80 kV/m did not affect the incidence of gross malformations or resorptions, nor did it change fetal orientations or the offsprings' sex ratios (*IEEE Transactions on Biomedical Engineering*, 31, 693, 1984; this paper also describes the exposure facility.) Still to come are the results on hematology. Some of these findings were presented at the 1982 BEMS meeting in Los Angeles, CA. In that paper, Majeau-Chargois reported a very significant decrease in white blood cells, as well as significant changes in spleen, kidney, adrenal and testes weights (see *MWN*, July/August 1982). According to Hsieh, the hematology results will appear in *Environmental Research*, 37, in August 1985. One

of the most interesting findings from the EPRI project was the demonstration of intensity windows at 60 Hz. The team discovered that exposure for five-and-a-half hours to a 10 kV/m 60 Hz field caused a highly significant, threefold elevation in the production of steroids by the rat's adrenal cortical tissue after in vitro administration of adrenocorticotrophic hormone (ACTH), but that 5, 100 and 1000 kV/m fields had no effect (*Life Sciences*, 32, 691, 1983). Hsieh said that additional papers are planned.

COMPATIBILITY & INTERFERENCE

ISM EMI to Aircraft...In 1982, the FAA signed a \$40,000 contract with the Avionics Engineering Center at Ohio University to determine, through calculations and measurements, the risks of EMI to aircraft avionics, especially with respect to instrument landing systems (ILS) and automatic direction finding (ADF) receivers (see *MWN*, September 1983). A final manuscript was sent to the FAA in the spring of 1984 and has been under review ever since. Last May, after the work had been completed, the center's James Nickum told *Microwave News* that he had turned up some interesting findings. For instance, he said that the ground-to-air propagation of ISM radiation is "significantly different" from ground-to-ground propagation. "There is certainly a need to address the issue of radiation interference to aeronautical services," Nickum said. While he did not advocate setting new standards, he did indicate that thought should be given to the advisability of siting ISM equipment near airports. (Last September, Nickum left Ohio to join the Collins Division of Rockwell International in Cedar Rapids, IA.) The FAA now estimates that the Ohio University report will be issued in May.

GOVERNMENT

FCC Steps Up Enforcement...The FCC seized electronic equipment valued at \$500,000 late last year, ending a

two-year investigation into the import of "non-type accepted" devices. In a raid on Granada Electronics of Brooklyn, NY, the commission confiscated more than 2,700 items illegally imported from the Far East, including CB radios, walkie-talkies and FM receivers, all of which are potential sources of RF interference. The CB radios, for example, are capable of operating at unauthorized frequencies and at power levels exceeding commission limits. Lawrence Wallach of L.W. Sales in Lynbrook, NY, was arrested for the unlawful sale of illegal CB transceivers. If convicted, the 27-year-old Wallach faces a maximum of 5 years in prison and \$5,000 in fines....In a separate action, in January the commission fined three distributors \$2,000 each for the repeated sale of cordless telephones that failed to meet the FCC's radiated power limitation. Those fined were TAD Avanti, distributor of the Record-a-Call CAT-100 and CAT-300; Dynascan, distributor of the Cobra CP915B; and Uniden, distributor of the Uniden EX-3100. The 46/49 MHz units were tested as part of the commission's upgraded sampling program.

LITIGATION

VDT Cataract Ruling...The New York State Workers' Compensation Board has ruled in favor of a secretary in what is believed to be the first successful claim of VDT-induced cataracts. Because the board ruled that the woman's cataracts "constitute an occupational disease arising out of and in the course of her employment," the January 2 decision may set a precedent for future claims. In its ruling (Case 0810 8929), the board found that "there is a recognizable link between the claimant's occupation and her disability." The decision was made on appeal after a workers' compensation law judge rejected the secretary's initial claim on August 26, 1983. No financial award was made, but Richard Spillane, the secretary's attorney, told *Microwave News* that the woman plans to file for compensation for lost work time and reduced earnings due to her condition. The secretary, Eileen Maguire of Staten Island, NY, was first diagnosed as having cataracts in August 1980, just seven months after she began working at a VDT. Four months after the diagnosis, she submitted a doctor's note to her employer, Shroder Bank and Trust Co. of New York City, stating that she could no longer work at a terminal. As a result, the company fired her in 1981.

Overviews...Microwave and VDT litigation were the subjects of two long articles in *The National Law Journal*. In the December 10 issue, John Parry advises law firms to do everything possible to integrate terminals properly into their office or risk the legal consequences. On the subject of radiation, he writes: "With regard to allegations of radiation injuries, the need for proximate causation makes recovery highly unlikely, except, perhaps, where a faulty VDT terminal is emitting radiation that exceeds federal limits. Even if scientific opinion in this country were to change and links were established, for example, between VDTs and cancer or birth defects, other elements of proof and employer defenses would substantially limit a firm's

liability." Parry is the staff director of the American Bar Association's Commission on the Mentally Disabled and the editor of the *Mental and Physical Disability Law Reporter*. The *Law Journal* article is an abridged version of a 19-page article published in the July-August 1984 issue of the *Reporter*: "Are VDTs Hazardous to Your Legal Health?" Reprints are available for \$5.00 (prepaid) from the *Reporter* at 1800 M Street, NW, Washington, DC, 20036, (202) 331-2240. In the January 28 *National Law Journal*, Kirk Victor describes the current state of microwave-related litigation: "Microwaves Stir New Generation of Battles." He writes: "Plaintiffs' lawyers have had their hopes set back by scientific studies that have not uncovered hard evidence of harm....But that lack of hard evidence has not stopped the speculation about the danger of microwaves or the continuing quest by plaintiffs' attorneys to probe the issue through a variety of pending suits — many of which are ultimately resolved by secret settlements."

MEDICAL APPLICATIONS

Kidney Stone Buster...The FDA has approved a shock wave device for the treatment of kidney stones. The "lithotripter" machine focuses shock waves, produced by an underwater high voltage condenser spark discharge, that shatter the brittle stones. Unlike ultrasound, the shock waves are single, sharply peaked impulses in the nanosecond range. The pulverized stones are then easily passed through the urine. A typical treatment involves up to 1,500 shock waves, given in a single session lasting about an hour. FDA estimates that this non-invasive technique could save \$2,000 per patient, compared to the \$6,700 cost of surgical removal. The treatment could be effective in 80 to 90 percent of the 100,000 cases now treated surgically in the U.S. each year. The \$1.7 million lithotripter was developed by Dornier System of West Germany.

MEETINGS

Tokyo EMC Meeting...The 1984 *International Symposium on EMC*, held in Tokyo, Japan, October 16-18, attracted more than 500 participants from 23 countries. Nearly 70 percent of the attendees were from Japan, with 15 percent from the U.S. The two-volume conference proceedings of close to 200 papers include the keynote address of Fumio Minozuma of the Ministry of Posts and Telecommunications: an historical review of radio noise activities in Japan. The 956-page proceedings will be available in the U.S. from the IEEE. They have not yet arrived from Japan and their U.S. price has not yet been set. (In Japan, the price is 10,000 yen, approximately \$40.00.) For more information, contact the IEEE conference office, 345 East 47th St., New York, NY 10017, (212) 705-7895.

MIT Goes to Scotland...Each year, Professor P. Lele of MIT's Department of Mechanical Engineering has been offering a summer course on the applications and hazards associated with microwaves, UV, ultrasound, lasers and

magnetic fields. This year, MIT is taking its summer school to the University of Stirling outside Edinburgh, Scotland, and Lele is going along. The course will be given from June 10-14; the cost for the week is \$1400, which includes tuition, food and lodging (golf may be extra). The deadline for applications is April 15. For those who want to take the course but would prefer not to travel so far, Lele will also offer it at MIT, August 5-9, for \$1050. Contact: Director of the Summer Session, MIT, Room E19-356, Cambridge, MA 02139, (617) 253-2101.

POWER LINES

Florida Tumor Cluster...Five girls living near 69 kV power lines developed an extremely rare type of ovarian cancer, endodermal sinus tumors, between 1974 and 1978. Four of the five, who were 1.5 to 18 years old and lived in Jacksonville, FL, died. Writing in *Oncology*, 41, 233, 1984, Drs. T.E. Aldrich, A. Glorieux and S. Castro note that these malignancies are "so rare that virtually no information has been compiled concerning their etiology" and that the cluster "is too remarkable to go unreported." The researchers argue that magnetic fields from the power line may have had a "mutagenic or promoter effect," complementing initiation by lead or polycyclic hydrocarbons from a nearby lead smelter plant and highway. They also raise the possibility that genetics, or some combination of genetic and environmental factors, played a role. (The five girls were black.) They conclude that "the power line hypothesis is only one interpretation and further research is obviously needed."

STANDARDS

IEC on Industrial Equipment EMC...The International Electrotechnical Commission (IEC) has issued two new standards on *Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment*. Publication 801-1, *Part 1: General Introduction*, which is a very brief overview of the problem, notes that the dominant source of industrial EMI is the walkie-talkie. Publication 801-2, *Part 2: Electrostatic Discharge Requirements*, applies to ESD generated by operators touching industrial equipment and ESD occurring between charged objects near the susceptible equipment — in both industrial and power generating plants. Part 2 establishes a reference test procedure and recommends severity levels. The documents are available from the International Sales Office of the American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018, (212) 354-3300. Part 1 costs \$10.00 and Part 2 costs \$29.00, plus postage.

Resources...NBS has released *Standards Activities of Organizations in the United States*, (SP-681). The directory summarizes the work of more than 750 organizations in the U.S., including federal and state agencies and more than 400 private groups. It is available, prepaid, for \$13.00 (\$16.25 foreign) from the Government Printing Office, Washington, DC 20402. Order No. 003-003-02602-

6....The January 1985 issue of the *IEEE Communications Magazine* features a number of articles on the standards work of the CCITT, IEC, IEEE, ISO and CEPT, with special reference to the structure and operation of these international groups.

VDTs

Legislation...Massachusetts State Senator Gerard D'Amico has introduced the first VDT bill of the new year in the U.S. The measure, which has not yet been assigned a number, requires periodic rest breaks, adjustable furniture and equipment, glare and noise control and semi-annual inspections of computer equipment. Under the bill, an employer would be required to provide, upon request, non-VDT work for a pregnant operator. If alternative work is not available, however, an employer can lay off the worker, who then becomes eligible for unemployment insurance. For more information, contact Barry Berman, Senator D'Amico's office, Room 413A, State House, Boston, MA 02133, (617) 969-7177....In Oregon, Senate Bill 57 would instruct the director of the state Workers' Compensation Department to develop voluntary purchasing and usage rules for VDTs as well as an educational program for VDT workers. The legislation was introduced by the standing Committee on Labor, chaired by Senator Margie Hendriksen, who sponsored Oregon's first VDT bill in 1983. The committee was acting on the recommendation of an interim labor committee, which held a series of meetings in 1984 and issued a report late last year (see *MWN*, November 1984). For copies of the bill and the report, contact Ms. Cheyenne Chapman, Committee on Labor, 331 State Capitol, Salem, OR 97310, (503) 378-5720....A Rhode Island study commission established last fall held a series of public hearings in January. The commission, which includes labor, industry and state representatives, as well as legislators, is planning to report its recommendations to the state assembly in February.

ETC

In the News...The January 14 issue of *The New Yorker* has a short piece on the New York Academy of Sciences' *Conference on Medical and Biological Effects of Light* (see *MWN*, December 1984). The anonymous author focuses on the pineal gland....The February *Omni* features a long article by science writer Kathleen McAuliffe on "The Mind Fields." McAuliffe begins by describing her tour of Dr. Jose Delgado's lab in Madrid, Spain, and goes on to delve into the scientific, medical and political controversies surrounding electromagnetic radiation from power lines, radar, VDTs, etc....Eric Lerner reviews the potential use of pulsed electromagnetic fields (PEMFs) for the treatment of osteonecrosis, osteoporosis and other bone ailments in the January *Esquire*. In the same issue, the magazine's editors present one of *Esquire's* Dubious Achievement Awards for 1984 to Professor Leonard Taylor of the University of Maryland for developing a way of shucking oysters with microwaves.

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VDT Legislative Report

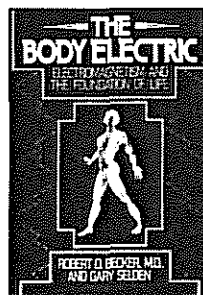
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A Report on Non-Ionizing Radiation

January/February 1986

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PEMFs: Project To Verify Delgado-Leal Effect Underway

An international project is underway to determine the extent to which extremely weak pulsed electromagnetic fields (PEMFs) are biologically active. Researchers in Europe and the U.S. are trying to replicate the results obtained by Dr. Jocelyne Leal, who, working in Dr. Jose Delgado's laboratory in Madrid, Spain, showed that magnetic fields many times weaker than the Earth's can profoundly upset the development of chick embryos.

The Delgado-Leal results, first published in 1982, have prompted widespread speculation that low-level magnetic fields may present greater risks to human health than previously suspected. Their experiments are, for instance, often cited by those concerned about the effects of working at video display terminals (VDTs), which emit weak PEMFs from their flyback transformers.

Project coordinator Dr. Thomas Rozzell of the Office of Naval Research (ONR) explained in a telephone interview that the participating labs are not trying to repeat the original experiment exactly because the exposure system will be somewhat different. "We are attempting to verify whether the phenomenon Leal originally found is real," he said.

Rozzell and Dr. Michael Marron, also of ONR, have been planning the experiments for the last two years. Rozzell returned last summer from a two-year stint in Europe, where he was in close contact with Leal and with Dr. Kjell Hansson-Mild, of the Swedish National Board of Occupational Safety and Health in Umea, who has been doing research based on the Madrid experiments (see *MWN*, June 1984).

(continued on p. 14)

OMB Okays EPA Options for RF/MW Limits

The Environmental Protection Agency (EPA) will soon issue a request for comments on four options to protect the general public from radiofrequency and microwave (RF/MW) radiation. The move follows a six-month review of the options by the Office of Management and Budget (OMB). EPA staffers were cautious about specifying when the options paper would be published in the *Federal Register*, because it must still be approved by senior EPA officials.

Informed sources told *Microwave News* that the agency will ask for advice on four courses of action. Three of these call for public exposure standards based on specific absorption rates (SARs) of 0.04, 0.08 and 0.4 W/Kg. The fourth option is to take no regulatory action.

At the most stringently regulated frequencies, 30-300 MHz, these SARs would result in power density limits of 100, 200 and 1,000 uW/cm², respectively. The 1982 American National Standards Institute (ANSI) guidelines are based on a SAR of 0.4 W/Kg.

(continued on p. 16)

RF Hot Spots on Cougar Mountain

Three localized hot spots, exceeding the 1 mW/cm² safety limit set by the American National Standards Institute (ANSI), have been identified in publicly accessible areas near an antenna farm on Cougar Mountain outside Seattle, WA. The maximum "spatially averaged" reading in a public space was 700 uW/cm². Radiofrequency (RF) radiation levels on broadcasters' property were generally much higher, often exceeding 1 mW/cm².

The measurements were made by a team from the Environmental Protection Agency (EPA) and the Federal Communications Commission (FCC) last May in response to public concerns over the health effects of RF radiation.

The FCC has asked eight of the ten FM broadcasters using the antenna farm to put up fences and/or post warning signs in order to correct the problem. The commission, which has adopted the ANSI limits as an exposure standard, also warned all ten FM broadcasters that their workers may face radiation health risks.

Some local residents are disturbed by the EPA-FCC findings and believe that the ANSI limits do not provide enough protection. "The FCC's use of the ANSI standard is forcing us to reside with radiation levels that exceed those selected as an occupational limit by the Johns Hopkins Lab, an organization that is free from the pressures of the communications industry," Monty Lennox, who lives near the antenna farm, told *Microwave News*. The Johns Hopkins standard is ten times stricter than ANSI's (see *MWN*, December 1984).

Survey Results

According to EPA's report, spatially averaged power densities exceeded 200 uW/cm² in about 5 percent and 100 uW/cm² in 11 percent of all locations surveyed in publicly accessible areas. Virtually all the measurements exceeded 1 uW/cm², a level which EPA has found is the upper range of exposure for most Americans.

A power level of 700 uW/cm² was measured within 25 feet of an FM radio tower. EPA notes that, although this is below the ANSI limit, it is well above the 200 uW/cm² safety limit adopted or recommended by the International Radiation Protection Association (IRPA), the state of Massachusetts and Multnomah County, OR.

The highest localized level measured was greater than 2.35 mW/cm², near a metal "chinning bar" in a private playground. Readings over 2 mW/cm² and just under 1.7 mW/cm² were taken in an unfenced area near a tower which supports 3 FM transmitters.

The highest spatially averaged and maximum localized fields inside homes were 23 and 305 uW/cm², respectively. The 305 uW/cm² reading was for an "unperturbed" field. Near a curtain rod in one bedroom the "perturbed" RF field was 352 uW/cm².

RF fields inside the broadcasters' properties were higher. In one lot with 3 towers supporting 4 FM stations, most of the readings were above 1 mW/cm² and a few exceeded 2 mW/cm². Under normal operating conditions, no

one works at the antenna farm full-time, though technicians come to maintain the antennas.

The EPA report notes that, "Although no measurements were taken at elevated locations on the towers, there is no question that a worker who ascends any of the FM towers ... will encounter fields that exceed the ANSI radiation protection guide."

Whole-Body v Partial-Body Exposures

The spatially averaged RF levels are approximations of whole-body exposures, EPA's Richard Tell said in a telephone interview. Tell, who led the measurement team, added that "it is a real issue how to interpret the hot spots."

As Tell's report points out, the localized, perturbed fields "are real and can result in relatively high partial-body exposures." None of the existing standards specify limits for partial-body exposures.

The FCC has raised the problem of occupational exposures with the broadcasters, but has not specified any corrective plan, according to William Hassinger of the commission's Mass Media Bureau. Among the options available are reductions in power, using alternative antennas and shutdowns. "Some of the stations may face tough choices," Hassinger told *Microwave News*.

Other findings of the survey:

- The measured RF levels were far lower than those predicted by EPA models.
- Vegetation, coniferous trees in particular, appears to be a good RF shield.
- FM stations are the only significant source of RF radiation on Cougar Mountain. In addition to the 10 FM antennas, there are several microwave point-to-point dishes and other low-power communication antennas on the 22 towers built on the mountain.
- All the measurements cited in the report were taken within ten feet of the ground, and "it is likely that the power densities increase as one moves to greater heights."

Cougar Mountain residents, who are opposing a Seattle TV station's proposal to construct a new transmitter (see *MWN*, May 1985), have also reported RF interference (RFI). According to the EPA report, "RF levels on virtually the entire mountaintop exceed the blanketing value" set by FCC regulations to protect against RFI. Hassinger said in a telephone interview that the commission does not plan to require stations to reduce the potential for RFI in nearby homes.

The EPA report, *An Investigation of Radiofrequency Radiation Exposure Levels on Cougar Mountain, Issaquah, WA, May 6-10, 1985*, is available from the FCC's duplicating contractor, International Transcription Services, 2100 M St., NW, Washington, DC 20037, (202) 857-3800.

Portland Is Next

The EPA-FCC team is scheduled to go to Portland, OR,

in May for the next series of broadcast radiation measurements. There has been much debate about the health risks of RF radiation in Portland, and the city's Planning Commission recently proposed a 200 uW/cm² safety standard for public exposures (see *MWN*, July/August and November/December 1985).

The FCC had hoped to measure radiation levels at two or three sites in 1986, but those plans are now uncertain in light of budget cuts forced by the Gramm-Rudman deficit reduction act. Travel funds have been slashed and one FCC staffer said that even the trip to Portland may no longer be possible.

NIOSH VDT Pregnancy Study Plan Rejected by OMB

The federal study of reproductive risks among video display terminal (VDT) users suffered a major setback in December when the Office of Management and Budget (OMB) rejected the research protocol submitted by the National Institute for Occupational Safety and Health (NIOSH). The OMB ruled that the protocol was poorly designed and that its results would not stand up to scientific scrutiny, according to an agency spokesman.

Dr. Teresa Schnorr, who is leading the NIOSH study, is confident that the OMB decision will be overturned. She said that she has already corrected several of the problems cited by the OMB and plans to appeal the December ruling using statements of support from the study's peer review panel. "OMB needs to see the other side of the coin, which will be the point of the appeal," she told *Microwave News*.

The OMB, which is responsible for fiscal oversight of the executive branch of the federal government, broadly criticized the NIOSH protocol on the following counts: (1) inadequate study population size; (2) incorrect definition of the "sampling frame," the statistical method by which the study population was selected; (3) poor definitions of major variables, and (4) inclusion of unnecessary questions in the survey questionnaire. "These deficiencies might lead to spurious correlations that might be incorrectly interpreted," the OMB concluded, noting, nevertheless, that NIOSH had "made a credible case for the conduct of a study." The OMB indicated that it would reconsider the proposal if NIOSH corrects the problems.

Bell South Critique

Bell South, one of two companies set to participate in the study, submitted a harsh critique of the protocol to both the OMB and NIOSH in late November. Prepared for the company by outside consultants, the assessment identified five basic flaws in the plan; three of the five are repeated in the OMB's evaluation, and the OMB's Edwin Dale acknowledged that Bell South's report influenced the agency's decision.

The critique was written by Dr. Brian MacMahon, chairman of the Department of Epidemiology at Harvard

Battelle ELF-Swine Study Out

As we go to press, the Electric Power Research Institute (EPRI) has released the Battelle study on the effects of 60 Hz fields on three generations of miniature swine. The report has been due for some time — the actual experimental research was completed four years ago.

Although most of the results indicated no ill effects, the study did find an increase in malformations and lower body weights among the third generation fetuses, compared to controls.

Microwave News will publish an in-depth report on the Battelle findings — including the controversy over the planned follow-up study — in our next issue.

The seven-volume report covers behavior (No.2), exposure system and dosimetry (No.3), growth, reproduction and development (No.4), hematology and serum chemistry (No.5), immunology (No.6), and neurology (No.7), and includes a summary volume (No.1). The principal investigators were Drs. Richard Phillips and Larry Anderson at Battelle Pacific Northwest Labs in Richland, WA. Phillips is now with the Environmental Protection Agency.

All seven volumes of the report, *Biological Studies of Swine Exposed to 60 Hz Electric Fields* (EA-4318), are available for \$197.50. Volumes 1, 5 and 7 cost \$32.50 each; the others are \$25.00 each. Order from Research Reports Center, Box 50490, Palo Alto, CA 94303, (415) 965-4081.

University's School of Public Health in Cambridge, MA, and Dr. Sally Zierler of Brown University in Providence, RI. Their analysis bluntly asserts that:

The likelihood that the study as described will achieve its stated objectives or satisfy the need [to address public concern]...is virtually nil. It is in our view inconceivable that the study would yield results that are definitive, unequivocal or credible and, even with the modifications that we will propose, such results cannot be assured with this study design.

MacMahon and Zierler cited five "critical flaws" in the NIOSH study design: inadequate definitions of pregnancy outcomes; excessive data collection; lack of concern for recall bias and other types of biases; incomplete medical records on pregnancy outcomes, and insufficient population size. They recommended ways to correct many of these flaws and suggested adding a question to the survey on the use of ultrasound during pregnancy. In addition, they urged that other study designs be considered.

Study History

NIOSH first announced its intention to study pregnancy risks among VDT operators in late 1982 and several times has been forced to scale back its research plans, in part

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because of strong objections by Bell South and AT&T, the second company that has agreed to participate (see *MWN*, November 1982, July/August 1983, January/February 1985). The study proposed to OMB would be primarily a retrospective survey of approximately 3,000 women, half of whom used VDTs regularly.

The study's repeated setbacks may now come under congressional scrutiny, adding to NIOSH's difficulties. *Microwave News* has learned that several influential congressmen are concerned about the agency's handling of the study and are conducting preliminary evaluations that could lead to full-scale investigations.

NIOSH documents submitted to the OMB indicate that the budget for the proposed study is considerably larger than previously reported. The annual cost for the two-year project would be approximately \$363,000, nearly quadruple the \$100,000 budget agency officials have estimated in the past.

TV/VCR Immunity: Progress Report

Manufacturers are designing greater immunity into their televisions and video cassette recorders (TV/VCR) but more progress still must be made, according to a report by an ad hoc committee set up in 1983 to develop voluntary immunity standards for home electronic equipment.

Among the findings of the committee of industry, government and amateur radio representatives are:

- Most television interference (TVI) complaints continue to come from the first and other harmonics of citizens band (CB) radio transmissions at 27 MHz. Federal Communications Commission (FCC) statistics nonetheless show that this type of TVI has been slowly decreasing over the last three years.
- Studies sponsored by the Electronic Industries Association (EIA) indicate that TV/VCR immunity varies considerably with frequency and among manufacturers. The most susceptible frequency is, as expected, the intermediate frequency (IF) at about 43 MHz. (The IF is the frequency to which RF signals are converted by the receiver during amplification.)
- Immunity is being designed into newer TV/VCR models, achieving protection at a lower cost. Shielded antennas are being used more and more.

Into the Antenna & the Chassis

The ad hoc committee addressed two types of TVI: (1) coupled into the antenna and (2) coupled directly into the chassis. In response to the committee's concerns, the EIA developed voluntary standards to guard against both types of interference (see *MWN*, January/February 1985), but the EIA limits have failed to win the support of the American Radio Relay League (ARRL).

With respect to TVI coupled into the antenna, the EIA guidelines are designed to protect against four-watt CB

transmissions. The ARRL prefers guidelines 20 dB stronger to protect against amateur radio and higher power (illegal) CB radio signals. Manufacturers counter that the EIA immunity levels are the highest now achievable.

All TV/VCR manufacturers will be expected to meet the EIA standard, and the trade group will survey compliance during 1986. According to the committee report, if the immunity limit is met but the number of consumer complaints does not decrease, a more stringent standard "should be considered."

Manufacturers favor a 1 V/m immunity level against direct radiation in the AM, amateur and CB radio bands, and a 0.3 V/m level at other frequencies. The ad hoc committee believes that these guidelines should be adequate for CB but may not be strong enough for amateur radio signals and suggests that "additional protection may be necessary."

Protection Distances

The committee estimated the distance between a given source of radiation and a TV/VCR beyond which no significant TVI occurs. For a four-watt CB radio, the "protection distance" for TVI coupled into the antenna is about 100 feet. CB harmonics can cause co-channel TVI within a mile. The separation distance for an amateur radio transmitter operating at 1,500 watts is approximately 2,000 feet, but this shrinks to about 700 feet if the power output is lowered to 150 watts.

For TVI coupled into the chassis, the protection distances can be quite large: up to 3.8 miles from 500-watt (40-46 MHz) pagers and 1.5 miles from an AM radio transmitter.

The models are still rough and the committee notes that they must be verified. In a telephone interview, committee Chairman Donald Heirman said that testing the models will be one of the committee's next major efforts.

Recommendations

The ad hoc committee recommends that:

- Not all TV/VCR manufacturers are participating in using the EIA voluntary standards. It is suggested that CEG/EIA [EIA's Consumer Electronics Group] take the necessary steps to ensure that all TV/VCR manufacturers marketing in the United States assess their immunity profile and strive to introduce greater immunity into their products as warranted.
- One of the measures for monitoring TV/VCR complaints is the FCC Field Operation Bureau unconfirmed complaint data. The committee feels that additional work is needed to further identify the nature of the complaints to properly assess whether *confirmed* complaints are increasing or decreasing.
- Since this report provides a significant description of the activity of the voluntary standards work in alleviating the need for regulations, the widest appropriate distribution is suggested.
- The ad hoc committee should be converted to a permanent standing committee of ANSI C63 so that continual monitoring of the progress of TV/VCR immunity can be assured.

The ad hoc committee was set up by the American National Standards Committee C63 on Electromagnetic Compatibility following the enactment of the Communications Act Amendments of 1982, which ordered that home electronic equipment be better protected against electromagnetic interference (see *MWN*, September and October 1982). The committee is seeking to develop voluntary standards to forestall mandatory FCC limits.

According to Heirman, this initial report will be followed by others, and the group will continue to meet on an approximately bimonthly schedule.

The members of the ad hoc committee are: Donald Heirman, AT&T Information Systems (chairman); Fred Huber, Jr., IEEE (secretary); Hector Davis, FCC; Harold Gauper, Jr., retired from GE; Frank Rose, FCC; Dr. Ralph Showers, University of Pennsylvania; Eb Tingley, EIA; Hugh Turnbull, ARRL; and Dan Yates, formerly with the FCC.

Those interested in obtaining a copy of *Initial Report: Immunity of Home Entertainment Devices (TV/VCR)*, December 1985 should contact Fred Huber, Jr., IEEE Standards Office, 345 East 47th Street, New York, NY 10017, (212) 705-7960.

Air Force Recommends 50 V/m Safety Level for VLF from GWEN

The U.S. Air Force has set a 50 V/m guideline for general population exposures to very low frequency (VLF) radiation. The limit is cited in a generic environmental impact statement (EIS) for the Air Force's Ground Wave Emergency Network (GWEN) communication system, which will operate at 150-175 kHz.

The 50 V/m standard was recommended by John Mitchell, chief of the Radiation Physics Branch at the School of Aerospace Medicine at Brooks Air Force Base in Texas. In a telephone interview with *Microwave News*, Mitchell said that the 50 V/m level is "very conservative," but that since GWEN is a very low power system there will be no problem meeting it.

Mitchell said that the 50 V/m exposure level is only intended to apply to GWEN transmitter sites and that exposure standards for other Air Force systems will have to be looked at on a case-by-case basis.

The Air Force standard for VLF occupational exposures is 100 mW/cm², the far field equivalent of 614 V/m. In a September 25, 1984 letter to the Air Force's Electronic Systems Division, Mitchell states that he recommended a 50 V/m guideline based on "new research data currently being generated under Air Force contracts," referring to results from the Universities of Utah and Washington that show increased risks of shocks and burns from VLF radiation (see *MWN*, July/August 1985).

The 50 V/m limit is stricter than all other Western standards: the American National Standards Institute's (ANSI) limits are also based on 100 mW/cm², though they apply to both workers and the general public (they only cover fre-

quencies down to 300 kHz). The International Radiation Protection Association (IRPA) has recommended a standard of 194 V/m for occupational exposures and 87 V/m for the general public for frequencies from 100 kHz to 1 MHz. On the other hand, the Soviet standard for 30-300 kHz is 25 V/m.

When it is completed in 1989, the \$700 million GWEN communication system will consist of up to 125 VLF relay nodes across the continental U.S. and a total of 400 receive and transmit stations. The network is intended to provide reliable communications after a nuclear attack and is designed to survive the effects of electromagnetic pulse (EMP) radiation. In addition, it operates at a frequency low enough to be unaffected by ionospheric disturbances.

According to computer modeling studies run by the Air Force, the 50 V/m limit would be met at between 105 and 151 feet from the antenna. Each GWEN antenna will sit on about 12 acres of cleared, level land.

Environmentalists and disarmament groups oppose the GWEN system. Peter Shelley, an attorney with the Boston, MA, Conservation Law Foundation (CLF), said in a telephone interview that the group may file suits to block construction at several GWEN sites once they are selected.

The Air Force has decided that the GWEN system will cause too little disruption to warrant preparing a full environmental impact statement (see the Air Force's September 6 *Federal Register* notice, 50 FR 36464).

A copy of the *Generic Environmental Assessment for the Ground Wave Emergency Network (GWEN)*, April 1985, is available from the Office of Public Affairs, Electronic Systems Division, Hanscom Air Force Base, MA 01731.

Mass. Adopts Sweeping RF/MW Worker Rules; NJ Proposal Due

The Massachusetts Department of Labor and Industries has adopted the most comprehensive regulations in the U.S. to protect workers from radiofrequency and microwave (RF/MW) radiation. The state exposure limits are based on those developed by the American National Standards Institute (ANSI).

Under the rules, which became effective on December 23, all employers installing new sources of RF/MW radiation must notify the state before turning them on. Owners of existing sources have a year to submit data to the Department of Labor and Industries. Among the sources covered are radio, television and radar stations with an input power of greater than 100 watts, RF sealers and heaters, industrial microwave ovens, and diathermy and hyperthermia equipment.

The other key elements of the state standard are:

- The prohibition of RF shocks and burns even in cases where the exposure standards are not exceeded;
- The designation of an "RF Safety Officer" by each employer using radiation equipment;
- The extension of the standard down to 10 kHz even

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though the ANSI guidelines cut off at 300 kHz;

- Annual surveys by all employers to check that radiation levels do not exceed the exposure limits — new equipment must be surveyed when it is installed; records must be kept for at least thirty years.

All facilities maintained by the federal government are exempt from the rules, as are amateur radio stations that are licensed by the Federal Communications Commission and hand-held portable and mobile radios with an input power of fewer than seven watts.

Variances are allowed under certain conditions, but worker exposures must never exceed ten times the ANSI values in such cases.

Broadcasters Win Delay

Radio and television broadcasters have asked for and have been granted a waiver from the rules until April 1. According to Frank Archibald of the department's Division of Occupational Hygiene, the broadcasters sought the delay in order to train safety officers, to buy the necessary radiation measuring equipment and to set up record-keeping procedures.

In 1983, Massachusetts became the first state to set an exposure standard for the general public: a level five times more stringent than ANSI's (see *MWN*, September 1983).

For more information, contact Frank Archibald, Division of Occupational Hygiene, Massachusetts Department

of Labor and Industries, 1001 Watertown St., West Newton, MA 02165, (617) 727-3982.

New Jersey Proposal Planned

The New Jersey Bureau of Radiation Protection will soon propose adopting the ANSI guidelines as the state's occupational standard. The state has already adopted the ANSI limits for exposures of the general public (see *MWN*, April 1984), and the forthcoming proposal will simply expand those covered to include workers. The New Jersey rule does not contain any of the reporting and surveying requirements specified by the Massachusetts regulations.

A public hearing on the new rules will be scheduled soon, according to Debbie Wenke, the supervisor of non-ionizing radiation programs at the bureau.

The proposal was developed by the Committee on Non-Ionizing Radiation of the New Jersey Commission on Radiation Protection. The committee is chaired by Dr. Fred Sterzer of RCA. In a telephone interview, Sterzer said that he and other members of the committee would prefer national RF/MW radiation standards for occupational and public exposures and only agreed to a state standard when the federal government failed to act.

For more information, contact Debbie Wenke, NJ Bureau of Radiation Protection, 380 Scotch Rd., Trenton, NJ 08628, (609) 292-5891.

Joe Towne Dies

Joe Towne, founder and president of the Radar Victims Network, died on April 8, 1985 in Sacramento, CA, at the age of 66. Towne had been ill for many years — he suffered his last stroke in January 1985 and was in a coma until his death.

From 1957 until retiring in 1966, Towne was an Air Force radar technician aboard an EC-121 Constellation, flying out of McClellan Air Force Base in Sacramento. Towne developed cataracts, heart ailments and a host of other ills. After much legal wrangling, the VA awarded him a 100 percent disability.

In 1969, Towne sued a number of the electronics companies — GE, Litton, Lockheed, Raytheon and RCA — that designed and built the EC-121s. Some offered to settle out of court on the condition that he not divulge the details of the case. Towne refused. Eventually he accepted a \$55,000 settlement, but he never shied away from an opportunity to tell people about the money he had received.

There were many other EC-121 radar technicians living near McClellan and, after an informal survey, Towne found that an unusually high percentage had cataracts at an early age. His discovery fueled his

concern, and he began warning people about the dangers of microwaves and helping those who had been overexposed.

In 1976, a small group of men, all of whom had serious medical problems, met in Framingham, MA, and formed the Radar Victims Network; Towne was named president. They agreed that they would direct their energies "toward the goal of securing an epidemiological study of microwave injury" and "to try and interest the medical profession in the diagnosis and treatment of microwave injury."

Although these goals were never really attained, the network grew until, at its height, it had more than 150 members. For the rest of his life, Towne served as a clearinghouse for others who thought that they had suffered ill effects from microwave radiation, helping them prepare their VA claims and providing them with moral support.

With Towne gone, the network is largely inactive. A number of the original organizers have died and many others are too sick to do the work. In fact, it took months for word to filter from one member to another that Joe had died.

NCRP Takes On Non-Ionizing Radiation

The National Council on Radiation Protection and Measurements (NCRP), long known for its studies on ionizing radiation, is increasing its activities on non-ionizing radiation. According to NCRP Executive Director Roger Ney, the move follows a decision by the council's board of directors that non-ionizing radiation has become a timely subject in need of greater attention.

Professor Herman Schwan of the University of Pennsylvania in Philadelphia has been invited to present the Taylor Lecture at the NCRP's annual meeting at 5 p.m. on April 2 at the National Academy of Sciences auditorium in Washington, DC. The title of his talk is "Non-Ionizing Radiation Bioeffects: Cellular Properties and Interactions."

Invited papers on extremely low frequency (ELF), radiofrequency and microwave (RF/MW) radiation and ultrasound, as well as briefings on ongoing NCRP studies, will be featured at the April 2-3 meeting. Among the presentations, Dr. Ross Adey will address "Electromagnetic Fields, Cell Membrane Amplification and Cancer Promotion."

Ongoing Studies

Four NCRP scientific committees (SC) are preparing reports on the bioeffects and measurement of electromagnetic radiation:

- **SC53: Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Radiation.** This committee, chaired by Professor Bill Guy of the University of Washington in Seattle, has been at work since 1977. According to Dr. Constantine Maletskos, the staff officer for the committee, the report is now at the printer and an index is in preparation. Maletskos is hopeful that the long-awaited report will be ready for distribution at the April meeting.

The report includes a review of the RF/MW bioeffects literature and recommends exposure standards. In the years in which the report has undergone extensive reviews, word has circulated that the committee has recommended an exposure limit of 200 $\mu\text{W}/\text{cm}^2$ for the general population at the most strictly regulated frequencies. Some sources have reported that the Guy group wavered between a 100 and a 200 $\mu\text{W}/\text{cm}^2$ standard before deciding on the higher limit to reduce the economic impact on the broadcasting industry. Maletskos declined to discuss the conclusions of the report prior to its publication.

In addition to Guy, the other members of the committee are: Drs. Ross Adey, Edward Alpen, Stephen Cleary, Don Justesen, Mary Ellen O'Connor and Richard Phillips. The advisors to the committee are: Drs. Eleanor Adair, Ed Hunt, Sol Michaelson, Harvey Ragan and Charlotte Silverman. The consultants to the committee are: Drs. C.K. Chou, Justus Lehmann, Richard Lovely, Jan Stolwijk and W.A.G. Voss.

- **SC67: Biological Effects of Magnetic Fields.** This committee has been at work for more than five years under the chairmanship of Dr. Dennis Mahlum of the Battelle Pacific Northwest Labs in Richland, WA. No date has

been set for completing its report. The members of the committee are: Drs. John Baum, John deLorge, Karl Illinger, Charlotte Silverman and Tom Tenforde. Dr. Tom Budinger is an advisor to the committee on issues related to nuclear magnetic resonance imaging. Dr. Tom Koval is the NCRP staffer working with SC67.

- **SC78: Practical Guidance on the Evaluation of Human Exposures to Radiofrequency Radiation.** SC78 was set up in 1983 under the chairmanship of Richard Tell of the Environmental Protection Agency (EPA) to develop simple guidelines for measuring electromagnetic fields in the 10 kHz to 100 GHz frequency range (see *MWN*, April 1984). According to Tell, a 237-page draft report has been prepared and is now being revised. He plans to submit a final draft for NCRP review this spring. The other members of the committee are: Howard Bassen, Jules Cohen, Dr. David Conover, Dr. Carl Durney and Ron Petersen. Dr. Tom Koval is the NCRP staffer assigned to the project.

- **SC79: Extremely Low Frequency Electric and Magnetic Fields.** SC79 was set up under a \$150,000 contract from the EPA in 1983 (see *MWN*, December 1983). According to committee Chairman Dr. Adey of the VA Hospital in Loma Linda, CA, a draft report should be forwarded to the NCRP by the end of 1986. The other members of the committee are: Drs. Carl Blackman, David Carpenter, Charles Ehret, William Feero, Richard Lovely, Genevieve Matanoski, Martin Misakian and Richard Phillips. Maletskos is the NCRP staff officer for the study.

VDTs

In the latter half of 1985, the NCRP set up an ad hoc group to look into the question of video display terminals (VDTs), under the chairmanship of Dr. George Wilkening of AT&T Bell Labs. The other members of the VDT group are Drs. Ed Alpen and Bill Guy. According to NCRP's Koval, the ad hoc group has no plans to issue a report, but may issue a statement if it deems one necessary. Wilkening will discuss the group's work at the meeting.

Completed Studies

Two NCRP studies on non-ionizing radiation have already been published:

- **Report No.67: Radiofrequency Electromagnetic Fields: Properties, Quantities and Units, Biophysical Interaction and Measurements** was issued in 1981. It was prepared by a committee chaired by Bell Labs' Wilkening (see *MWN*, October 1981). Price: \$13.00.

- **Report No.74: Biological Effects of Ultrasound: Mechanisms and Clinical Implications** was issued in 1983. It was prepared by a committee chaired by Dr. Wesley Nyborg of the University of Vermont in Burlington. Price: \$16.00.

These reports can be ordered from NCRP Publications, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652. The prices include postage and handling.

RF Exposures: FCC's Advisory Guidance to Broadcasters

Reprinted below are excerpts from the Federal Communications Commission's (FCC) Further Guidance for Broadcasters Regarding Radiofrequency [RF] Radiation and the Environment, which was released on January 28. The commission previously had issued a technical bulletin, Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to RF Radiation (Office of Science and Technology (OST) Bulletin No.65). This Further Guidance gives broadcasters general instructions for compliance with the commission's rules on human exposures to RF radiation under the National Environmental Policy Act (see MWN, April and September/October 1985).

...As of January 1, 1986, all applications for new facilities, modifications to existing facilities and renewals must contain either a specific indication that the RF radiation of the particular facility or operation will not have a significant environmental impact or an environmental assessment which will serve as the basis for further Commission action...

Most broadcasting facilities produce high RF radiation levels at one or more locations near their antennas. That, in itself, does not mean that the facilities significantly affect the quality of the human environment. Each situation must be examined separately to decide whether humans are or could be exposed to high RF radiation. Paragraph 37 of the *Report and Order* [50 FR 11151, March 20, 1985] points out that accessibility is a key factor in making such a determination. As a general principle, if areas of high RF radiation levels are publicly marked and if access to such areas is impeded or highly improbable (remoteness and natural barriers may be pertinent) then it may be presumed that the facilities producing the RF radiation do not significantly affect the quality of the human environment and do not require the filing of an environmental assessment.

Because we wish to avoid burdening applicants with unnecessary work, expenses and administrative filings, we offer the following guidance as to how we will view typical situations. The term "high RF level" means an intensity of RF radiation, whether from single or multiple sources, which exceeds the ANSI guidelines.

Situations

(A) High RF levels are produced at one or more locations above ground level on an applicant's tower:

If the tower is marked by appropriate warning signs, the applicant may assume that there is no significant effect on the human environment with regard to exposure of the general public.

(B) High RF levels are produced at ground level in a remote area not likely to be visited by the public:

If the area of concern is marked by appropriate warning signs, an applicant may assume that there is no significant effect on the human environment with regard to exposure of the general public. It is recommended that fences also be used where feasible.

(C) High RF levels are produced at ground level in an area which could reasonably be expected to be used by the public (including trespassers):

If the area of concern is fenced and marked by appropriate warning signs, an applicant can assume that there is no significant effect on the human environment with regard to exposure of the general public.

(D) High RF levels are produced at ground level in an area which

is used or is likely to be used by people and to which the applicant cannot or does not restrict access:

The applicant must submit an environmental assessment. This situation may require a modification of the facilities to reduce exposure or could lead to a denial of the application.

(E) High RF levels are produced in occupied structures, on balconies or on rooftops used for recreational or commercial purposes:

The applicant must submit an environmental assessment. The circumstances may require a modification of the broadcasting facility to reduce exposure or could lead to a denial of the application.

(F) High RF levels are produced in offices, studios, workshops, parking lots or other areas used regularly by station employees:

The applicant must submit an environmental assessment. The circumstances may require a modification of the facilities to reduce exposure or the application may be denied. This situation is essentially the same as (E). We have included it to emphasize the point that station employees as well as the general public must be protected from high RF levels. Legal releases signed by employees willing to accept high exposure levels are not acceptable and may not be used in lieu of corrective measures.

(G) High RF levels are produced in areas where intermittent maintenance and repair work must be performed by station employees or others:

ANSI guidelines also apply to workers engaged in maintenance and repair. As long as these workers will be protected from exposure to levels exceeding ANSI guidelines, no environmental assessment is needed. Unless requested by the Commission, information about the manner in which such activities are protected need not be filed. If protection is not to be provided, the applicant must submit an environmental assessment. The circumstances may require corrective action to reduce exposure or the application may be denied. Legal releases signed by workers willing to accept high exposure levels are not acceptable and may not be used in lieu of corrective measures.

The foregoing also applies to high RF levels created in whole or in part by reradiation.

A convenient rule to apply to all situations involving RF radiation is the following:

- (1) Do not create high RF levels where people are or could reasonably be expected to be present and
- (2) Prevent people from entering areas in which high RF levels are necessarily present.

Fencing and warning signs may be sufficient in many cases to protect the general public. Unusual circumstances, the presence of multiple sources of radiation and operational needs will require more elaborate measures.

Intermittent reductions in power, increased antenna heights, modified antenna radiation patterns, site changes or some combination of these may be necessary, depending on the particular situation.

For further discussion see Office of Science and Technology Bulletin No.65, *Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation*,

October 1985. Copies of this bulletin may be ordered from the National Technical Information Service, [Springfield, VA 22161], (800) 336-4700, Order No. PB 86-127081 [\$11.95].

For further information regarding this *Notice* applicants should contact the AM Branch, FM Branch, TV Branch or LPTV/Translator Branch, as appropriate.

ANS C95 on ELF Exposure Standards

At a meeting held in July 1984, the American National Standards (ANS) Committee C95 on Non-Ionizing Radiation Hazards asked Dr. Richard Phillips of the Environmental Protection Agency (EPA) in Research Triangle Park, NC, to set up an ad hoc committee to consider the merits of an exposure standard for extremely low frequency (ELF) radiation (see MWN, October 1984). Reprinted below is Phillips's report, sent to Professor Saul Rosenthal, chairman of C95, on June 14, 1985. Standing Subcommittee C95.IV addresses "Safety Levels and/or Tolerances with Respect to Personnel."

Dear Professor Rosenthal:

At the ANS C95.IV meeting held at the Omni Hotel in Atlanta, GA, on July 15, 1984, you requested I form and head up an Ad Hoc Committee to investigate the feasibility of expanding the frequency range of ANS C95.IV to include ELF electromagnetic radiation: of particular interest was 60 Hz electric and magnetic fields from power generation and distribution systems. It is my understanding that this Ad Hoc Committee was formed in response to a request by Dr. Charles L. Wagner, President of the IEEE Power Engineering Society (PES).

In response to your charge, I formed a committee consisting of four scientists with extensive knowledge in the subject area: Dr. William Wisecup, Aerospace Corporation, quality assurance monitor of DOE, New York and EPRI projects dealing with the biological effects of 60 Hz electric and magnetic fields; Dr. H.B. Graves, Pennsylvania State University, a scientist who has been active in investigating the biological effects of 60 Hz electric fields since the early 1970s; Dr. William Feero, private consultant, a member of the IEEE/PES and founder of the DOE research program on the biological effects of 60 Hz electric and magnetic fields; and Dr. Jack Lee, Bonneville Power Administration, who heads up the BPA research program on the environmental impact of power transmission lines.

Primary sources of biological information for our assessment came from peer-reviewed published papers in the literature, technical reports and four recent critical reviews in the literature:

1. *Environmental Health Criteria 35: Extremely Low Frequency (ELF) Fields*, World Health Organization, 1984.
2. *The Health and Safety Effects of High Voltage Transmission Lines*, Report of a Joint Subcommittee, Senate Document No. 11, Commonwealth of Virginia, Richmond, VA, 1985.
3. *Biological and Human Health Effects of Extremely Low Frequency Electromagnetic Fields: Post-1977 Literature Review*. American Institute of Biological Sciences, Arlington, VA, March 1985.
4. *Biological Effects of 60 Hz Power Transmission Lines*. A Report of the Florida Electric and Magnetic Field Science Advisory Commission, Florida Electric Power Coordination Group, Tampa, FL, March 1985.

The information contained in these four critical reviews represents the views of the majority of scientists who are active in this area of research, and decision makers who are concerned with the impact of ELF electromagnetic fields on the environment and life forms, particularly human beings....

In general, the conclusion of these reviews is that there is no

reliable and documented evidence that exposure to ELF electric and magnetic fields of the range encountered in the vicinity of ELF radiation sources (i.e., 50/60 Hz transmission lines, ELF communication systems) causes significant or adverse biological reactions in human beings. However, a number of caveats are stated with these conclusions:

1. Exposure to electric and/or magnetic fields in the ELF can cause a variety of effects at any of several levels of biological organization in animals and in vitro systems, but interpretation of these data and extrapolation to human beings is not possible at this time.
2. Results from clinical, mortality and epidemiological studies are inconsistent and inconclusive, but call attention to the need for well conducted studies on the cancer incidence and exposure to low-level magnetic fields.
3. Additional research is needed before data derived from laboratory studies on animals can be extrapolated to potential effects on human beings.

Major issues of concern are the reported correlations between ELF radiation and cancer (mortality and epidemiological studies), alterations in fetal development, disruption of normal circadian rhythmicity, alteration in neural function, and cellular/membrane effects with low-level exposures at windows in frequency and amplitude.

The question as to whether or not sufficient information exists to require and establish a safe exposure guideline is debatable. Debates on this issue to date have been occurring among scientists, and within legal proceedings dealing with rights-of-ways for high voltage transmission lines. No vehicle has been established to date for a gathering of interested and impacted individuals and groups to discuss, debate and hopefully resolve the issue concerning the safety aspects of ELF radiation. It is our opinion that ANS C95.IV might be the appropriate vehicle. There is a need for scientists, regulators, producers, users and the general public to discuss the issue in an open forum such as ANS C95.IV. Major issues that need to be discussed are:

1. What is our current state of knowledge?
2. Is there a risk associated with exposure to ELF radiation? If so, at what level and duration of exposure?
3. Are safe exposure guidelines needed?
4. Is there sufficient information to establish safe exposure guidelines?
5. What will be the impact of an exposure guideline on energy production, distribution and costs?
6. If a risk exists, is it greater than the benefits?
7. Can a consensus be reached among concerned parties?

Whether or not ANS C95.IV should take on the responsibility and lead role on this issue needs to be discussed at the ANSI meeting in June in San Francisco. It should be noted that action is being taken by regulators in several states, and NCRP has formed a committee to address this issue. To date EPA has not been authorized to produce an exposure guideline for ELF radiation, but has initiated research on biological effects of ELF radiation.

Sincerely yours,
Richard D. Phillips

BIOLOGICAL EFFECTS

PEMFs Stimulate Tumor Cells...Pulsed electromagnetic fields (PEMFs) can promote the growth of embryonal carcinoma (EC) cells and inhibit their differentiation, according to a report from Kagoshima University in Japan. Dr. Takuya Akamine and coworkers exposed the EC cells for 84 hours to rectangular-shaped pulses with a width of 130 microseconds and a frequency of 100 Hz. The field was either 1 gauss and 5 V/m or 10 gauss and 53 V/m; both levels caused significant changes. The researchers do not know the mechanism by which the PEMFs inhibit cell differentiation — whether it is the magnetic field itself or the induced current. They note that their results suggest that the PEMFs may be interfering with the later stages of cell differentiation and that the inhibitory effect is consistent with the Delgado-Leal papers on the action of PEMFs on chick embryos. The authors warn that the “application of PEMF[s] in the treatment of malignant tumors should be performed with the greatest caution.” Their paper appears in the August issue of the *Journal of Cellular Physiology*, pp.247-254.

UV-A and DNA...Near-ultraviolet (UV), or UV-A, radiation (320-420 nm), long believed to be benign, may affect DNA in ways that “could have far-reaching, harmful effects on cells,” according to Drs. Meyrick Peak and Jennifer Peak of the Argonne National Laboratory (ANL) in Argonne, IL. The Peaks have found that UV-A can cause single-strand breaks (breaking the backbone of the DNA molecule) and DNA-to-protein crosslinks (creating a strong covalent bond between them). In a discussion of their findings in the autumn 1985 *Logos*, an in-house ANL publication, they hypothesize that UV-A “starts chains of chemical reactions that somehow trap and pass on energy in a form that allows a portion of it, through random diffusion and decay, to damage DNA.” One possible pathway is through “sensitizing” molecules like porphyrins (which are parts of hemoglobin and chlorophyll) that absorb the radiation and transfer it to molecular oxygen, exciting it to electronically reactive forms which migrate through the cell before decaying. If the excited species come near DNA when they decay, the energy released can cause breaks and crosslinks. The Peaks suspect that, because living cells have been exposed to UV-A for millions of years, mechanisms have evolved to offset its effects. *Logos* is available from the Office of Public Affairs, ANL, 9700 S. Cass Ave., Argonne, IL 60439.

Club Med Dermatitis...First there were supermarket workers who developed rashes after touching fruits and vegetables, and then school children who used limes in art class developed a similar condition (see *MWN*, March and September/October 1985). Now comes the latest example of photodermatitis: “Club Med Dermatitis.” Writing in the January 30 *New England Journal of Medicine*, Dr. Wain White of the New York University Medical Center in New York City tells of a tender rash on both thighs of a patient who had just returned from a Caribbean vacation. White attributed the rash to a Club Med “drinking game, during

which participants would balance and roll limes up and down their laps and closed thighs.” The limes probably secreted furocoumarins, which were then activated by sunlight.

COMPATIBILITY & INTERFERENCE

Power Transients Software...The Electric Power Research Institute (EPRI) has published the *Electromagnetic Transients Program (EMTP) Primer*, a manual for users of the EMTP software program, developed by the Bonneville Power Administration and several other utility and academic groups over the last 15 years to help utilities run inexpensive in-house analyses of high-speed power system transients. The software is complex and difficult to learn — hence the need for a tutorial. The EPRI primer, prepared by S.F. Mauser and T.E. McDermott of Westinghouse's Advanced Systems Technology Division in Pittsburgh, PA, is written for electrical engineers and assumes a working knowledge of both transients and computer simulation. It includes eleven detailed cases as teaching examples. The primer is only one of a number of EPRI initiatives now underway to improve the EMTP. These include a revised version of the program itself, a workbook for new users and a users group hotline. The primer, Report No. EL-4202, is available for \$40.00 from the Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081.

Electroexplosives...The Applied Physics Lab at the Franklin Research Center in Philadelphia is a focal point for the study of explosive devices and their associated electrostatic and electromagnetic hazards. The center offers training courses, publishes a newsletter and organizes a symposium every two-and-a-half years. The *Electroexplosives Devices Training Course: “Hands On” Applications* will be offered May 13-15 and October 14-16 and costs \$475. A week-long course, the *Joseph McLain Memorial Seminar on Explosives and Pyrotechnics*, which is very similar to the shorter course but offers more emphasis on chemistry, will be given August 18-22 and costs \$650. Both courses will be held in Philadelphia. The four-page newsletter, *explosives and pyrotechnics*, is published monthly and is available by subscription for \$40 a year. The *13th Symposium on Explosives and Pyrotechnics* will be held at the Hyatt on Hilton Head Island, SC, December 2-4. For more information, contact Ramie Thompson, Applied Physics Lab, Franklin Research Center, Philadelphia, PA 19103, (215) 448-1555.

COMPUTERS

PC Aides...Computer programs are now available for analyzing radar patterns, designing antennas and planning point-to-point microwave transmission lines on IBM and IBM-compatible personal computers (PCs). Technology Service Corp. (TSC) has developed a “Radar Workstation” so that engineers can calculate and analyze radar patterns at their desks without using large mainframes or time-sharing computers. The software can simulate vari-